VOL. X, NO. 1 JULY, 1938

PROCEEDINGS

OF THE

HAWAIIAN ENTOMOLOGICAL SOCIETY

FOR THE YEAR 1937

HONOLULU, HAWAII
PRICE 75 CENTS

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1937

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All correspondence should be addressed to the Secretary, Hawaiian Entomological Society, Honolulu, Hawaii, from whom copies of the Proceedings may be purchased.

Volume I of the Proceedings, for 1905-07 (in five numbers), contains 210 pages, 4 plates, and 5 text figures.

Volume II, 1908-12 (in five numbers), contains 311 pages, 7 plates, 5 cuts, and 1 portrait.

Volume III, 1913-17 (in five numbers), contains 500 pages, 8 plates, and 6 cuts.

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Volume IX, 1934-36 (in three numbers), contains 468 pages, 19 plates, and 25 cuts.

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PROCEEDINGS

OF THE

Hawaiian Entomological Society

VOL. X, No. 1 FOR THE YEAR 1937 JULY, 1938

JANUARY 7, 1937

The 373rd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., Honolulu, on January 7, 1937, at 2:30 p. m.

Members present: Miss Amy Suehiro, Messrs. Bianchi, Bryan, Donaghho, Ehrhorn, Fullaway, Illingworth, Krauss, McBride, Rosa, Sakimura, Van Zwaluwenburg, Williams, and Zimmerman.

President Rosa called the meeting to order.

The minutes of the preceding meeting were read and approved.

REPORTS OF OFFICERS AND COMMITTEES

Mr. E. M. Ehrhorn, appointed by the Chair to audit the report of the treasurer of the Society, for the year ending December 2, 1936, reported that he had found the accounts correct. It was moved, seconded and passed that Mr. Ehrhorn's report be accepted.

President Rosa appointed Messrs. Ehrhorn, Fullaway, and Williams to welcome Dr. and Mrs. W. M. Mann, passing through Honolulu on January 25. Dr. Mann is Director of the National Zoological Gardens, Washington, D. C., and also an entomologist of note.

PAPERS PRESENTED

Mr. E. C. Zimmerman presented a paper entitled: "Revision of the Fijian Ottistirini (Coleoptera, Curculionidae)".*

NOTES AND EXHIBITIONS

Mr. N. Krauss reviewed H. L. Sweetman's book entitled: "The Biological Control of Insects," 1936 (Comstock Publishing Co.).

He also submitted the following observations: Heavy infestation of *Herse cingulata* (Fabr.) on *Ipomoea insularis* noted at Waimanalo on Dec. 15, 1936. Three mynah birds were seen within a short distance, each with a larva in its beak.

Selenothrips rubrocinctus (Giard).—Mr. Krauss reported that the thrips reported as causing extensive silvering of guava and Java plum leaves and browning and cracking of guava fruits in Kamokunui Valley, Oahu (Proc. Haw. Ent. Soc., Vol. 8, p. 385, 1934) had been identified as *Selenothrips rubrocinctus* (Giard) by Dudley Moulton.

* Withdrawn for publication by B. P. Bishop Museum.

Asterolecanium pustulans (Ckll.).—This species was brought in by Dr. Illingworth from the garden of G. P. Wilder, Makiki. The scales entirely encrusted and killed the branches of a Tahitian plant, the red lova lova. The species was determined by Mr. Ehrhorn, who has reported this scale several times in the early numbers of our Proceedings.

Enallagma civile (Hagen).—Dr. F. X. Williams said that the recently discovered blue damselfly *Enallagma civile,* immigrant from the American mainland, was found quite common on the lowlands of West Maui in late December 1936.

Mr. Bryan exhibited and briefly reviewed the following papers by Elwood C. Zimmerman, recently issued as Occasional Papers by B. P. Bishop Museum:

Cryptorhynchinae of Henderson, Pitcairn, and Mangareva Islands, O. P. XII, No. 20, 8 pp., 1 fig., Dec. 5, 1936.

A Cryptorhynchid from Marotiri.
O. P. XII, No. 21, 4 pp., 1 fig., Dec. 5, 1936.

Orochlesis of Fiji.
O. P. XII, No. 22, 10 pp., 1 fig., Dec. 5, 1936.

There was a general discussion of the termite problem in the Hawaiian Islands.

FEBRUARY 4, 1937

The 374th meeting of the Hawaiian Entomological Society was held at the H.S.P.A. Experiment Station on February 4, 1937, at 2:30 p. m.

Members present: Miss Amy Suehiro, Messrs. Bianchi, Bryan, Carter, Ehrhorn, Fullaway, Illingworth, Krauss, Mason, McBride, Rosa, Sakimura, Van Zwaluwenburg, Williams, and Zimmerman.

Visitors: Mabel Chong, Chas. Hoyt, and H. Darwin Kirschman.

President Rosa called the meeting to order.

The minutes of the preceding meeting were read and approved.

The Secretary-Treasurer read a memo approved by the Society, and then submitted to the Territorial Board of Agriculture and Forestry. It urged that, for the common good, the practice of commercial insect control and/or extermination be regulated.

Mr. E. H. Bryan, Jr., presented a useful summary of the present stock on hand of the Proceedings of the Hawaiian Entomological Society.

PAPERS PRESENTED

Dr. Carter presented a paper entitled: "A New Species of Gall Midge Predacious on Mealybugs," by Dr. E. P. Felt.

Mr. E. C. Zimmerman presented a paper entitled "The Genus Phanerostethus in Fiji (Coleoptera, Curculionidae)".*

* Withdrawn for publication by B. P. Bishop Museum.

NOTES AND EXHIBITIONS

Mr. F. Bianchi said that the East African fruit fly and parasite material collected by Mr. N. Krauss and himself had been examined in Washington, D.C. by Government Entomologists and that a report sent to Mr. O. C. McBride of the U.S.D.A. at Honolulu showed some new species of these insects.

Coccus viridis Green.—Dr. Illingworth reported observations on control of this troublesome scale. During the winter season it increases on such garden plants as: *Ixora, Plumieria, Fitchia, Citrus,* etc. It is a difficult pest to control with ordinary oil-emulsion sprays. An atomized Deo-Base oil to which pyrethrum extract had been added gave perfect control with no injury to the foliage. *Plumieria* that were not sprayed soon attracted natural enemies of the scale. Most noticeable were the white, woolly larvae of lady bird beetles, *Azya luteipes* Muls., which came in great numbers. *Cryptolaemus montrouzieri* Muls. was also present. Internal parasites were also doing their work, as evidenced by holes in the scales. Hence there is some question as to whether artificial control measures should be applied. This would check these valuable natural enemies, as well.

Litomastix floridana (Ashm.).—Dr. Illingworth reported rearing caterpillars of *Plusia chalcites,* which were a serious pest of lettuce during the rainy weather of January. Of the 26 caterpillars under observations, 8 died of bacterial wilt; 4 spun up but later turned black and died; 12 pupated, and emerged as moths; only 2 were parasitized by this tiny wasp—about 8%. Since Swezey discovered this parasite, Feb. 27, 1929, records of parasitism have averaged better than 50% during the warmer portions of the year, and this has resulted in a marked decrease in Plusia devastation in our gardens. Evidently cold rainy weather gives these tiny wasps a real set-back and Plusia becomes a serious pest. A spray of atomized Deo-Base oil mixed with pyrethrum extract successfully controlled the outbreak.

Mr. R. H. Van Zwaluwenburg mentioned that branches of panax (*Nothopanax*) hedge plants in Nuuanu Valley had been gnawed more than half through by some rodent, probably a tree rat. These branches were well off the ground where attacked.

Dr. Walter Carter reported that the wasp *Anagyrus coccidivorus* imported from Brazil by Mr. D. T. Fullaway, had been found established on the pineapple mealybug on Molokai and Oahu. He also spoke of the recovery here of *Hambletonia,* another neotropical wasp parasitic on this mealybug. Dr. Carter then exhibited specimens of the new midge that destroys the pineapple mealybug.

Dr. F. X. Williams exhibited a collection of insects made by F. C. Hadden, Quarantine Entomologist, on Midway Island.

He also showed specimens of a new species of a *Neoclytarlus** longicorn beetle that he had reared from unhealthy or nearly dead stems of the native pigweed bush *Chenopodium oahuensis* collected on the middle slopes of Palikea, Waianae Mts., Oahu, Nov. 1936. Wasp parasites emerging from this material were identified by Mr. D. T. Fullaway as *Ischiogonus palliatus* (Cam.) and *Hormiopterus vagrans* Bridw.

Mr. Bryan exhibited the following recent Bishop Museum Occasional Papers: William Morton Wheeler, Ants from the Society, Austral, Tuamotu, and Mangareva Islands, vol. 12, no. 18, 17 pp. Dec. 31, 1936. Records 29 spp. and 2 subspp. of ants, mostly vagrants, and describes two new species, one from Rapa related to Antarctica and the other from Tahiti, to Papua and Malay Archipelago.

Elwood C. Zimmerman, Cryptorhynchinae of the Society Islands, vol. 12, no. 23, 48 pp., 4 figs., Dec. 31, 1936. Records 46 species of these weevils, with keys, describing 26 as new. The sweet potato weevil, *Euscepes batatae* (Waterhouse), is synonymized with *Euscepes postfasciatus* (Fairmaire).

MARCH 4, 1937

The 375th meeting of the Hawaiian Entomological Society was held at the H.S.P.A. Experiment Station, Thursday, March 4, 1937, at 2:30 p. m.

Members present: Miss Amy Suehiro, Messrs. Bianchi, Bryan, Carter, Ehrhorn, Fullaway, Illingworth, Ito, Mason, McBride, Rosa, Sakimura, Swezey, Van Zwaluwenburg, Weinrich, Williams, and Zimmerman.

Visitors: Miss Mabel Chong and Donald Mitchell.

President Rosa called the meeting to order.

The minutes of the previous meeting were read and approved.

PAPERS PRESENTED

Mr. E. C. Zimmerman presented a paper entitled: "Two Insect Immigrants New to the Hawaiian Fauna." (A weevil and a drosophilid fly).

Mr. E. C. Zimmerman presented a paper entitled: "Storeus in Fiji (Coleoptera, Curculionidae)".*

NOTES AND EXHIBITIONS

Takahashia japonica (Ckll.).—Dr. Illingworth brought in specimens on a Kuhio vine (*Ipomoea Horsfalliae*). Mr. Ehrhorn identified the specimens.

Empoasca solana De Long.—Dr. Illingworth reported bean plants destroyed in his garden at Kaimuki. Mr. Swezey identified

* Described by Dr. Perkins on page 59 of this issue.

* Withdrawn for publication by B. P. Bishop Museum.

the jassids as the species that he had previously reported several times from *Amaranth, Datura,* and other weeds. It was identified by Mr. F. W. Poos of Arlington Farm, Va. (P. H. E. S., VIII, 226, 1933).

Mr. D. T. Fullaway exhibited specimens of *Phenacoccus gossypii* Towns. and Ckll. on *Dombeya,* the first record of its occurrence in Hawaii.

With reference to Mr. Zimmerman's paper on Two Insect Immigrants New to Hawaii, Dr. Walter Carter mentioned that the drosophilid fly *Chymomyza procnemis* (Williston) was found on prematurely blossoming *Ananas* (pineapple) flowers and bred out of butt rot material of pineapple at Kunia, Oahu, and was also observed in the Kipapa region, Oahu, last year. It is spreading.

Mr. E. H. Bryan, Jr., introduced Mr. Donald Mitchell, teacher of biology at the Kamehameha School for Boys.

Mr. O. H. Swezey gave a very interesting talk on his and Mrs. Swezey's sojourn in Guam and the voyage to the Orient. He described the topography and botany of Guam and remarked that a good forest was conveniently near for collecting and making observations. Many photographic scenes and boxes of insect specimens were shown. Mr. Swezey reared a considerable number of Lepidoptera, a field hitherto but little touched in Guam. Good collecting was also to be had at lights there. Among other insects, mention was made of a leafroller caterpillar that kills or severely injures the growing tips of the guava.

APRIL 1, 1937

The 376th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., on April 1, 1937, at 2:30 p. m.

Members present: Messrs. Bryan, Carter, Ehrhorn, Ito, Keck, McBride, Marlowe, Rosa, Sakimura, Swezey, Van Zwaluwenburg, Williams, and Zimmerman.

President Rosa called the meeting to order.

The minutes of the previous meeting were read and approved.

PAPERS PRESENTED

Mr. E. C. Zimmerman presented two papers, the one entitled "Note on Typhlonesiotes swaluwenbergi Jeannel", and the other "A Note on Limnastis and Nesomicrops (Coleoptera, Carabidae)".

On behalf of Dr. R. C. L. Perkins, Dr. F. X. Williams presented a paper entitled: "Another new Cerambycid in Hawaii".

Mr. E. C. Zimmerman presented a paper entitled: "Idotasia of Fiji (Coleoptera, Curculionidae)".*

* Withdrawn for publication by B. P. Bishop Museum.

NOTES AND EXHIBITIONS

Plagithmysus cuneatus Sharp.—Mr. Swezey exhibited 2 fine females of this endemic cerambycid which had issued from a section of *Sapindus oahuensis* tree brought in from near Palikea in the Waianae Mountains, February 22, 1937. There were many of the *Sapindus* trees in the region, and most of them showed injury by the larvae of this beetle. Some partially dead trees showed a great deal of the work of the larvae, i.e., the scorings of the branches where the bark was removed, and there were numerous exit holes through the bark where adult beetles had issued. Some beetles were cut out of their cells in the wood. This is one of the species of *Plagithmysus* which injures living trees.

Mr. E. M. Ehrhorn exhibited two staphylinid beetles found on Oahu.

Dr. F. X. Williams stated that Mr. E. T. Cresson, Jr., had recently described (Trans. Am. Ent. Soc., 62, p. 259, 1936) two new flies from Oahu. They are *Hydrellia williamsi,* bred from *Lemna* or duckweed, and *Hydrellia hawaiiensis,* not reared. Both are from the lowland Waianae portion of the Island.

He also exhibited what appears to be an immigrant ephydrid fly, provisionally identified as *Lytogaster willistoni* Cress., common in California. It was swept off a wet spot on the Tantalus trail in March. It was relatively scarce.

In studying the biology of flies of the genus *Scatella,* common about streams, reservoirs, sea shore, etc., a species additional to the five already described, was found. It can be caught in the same sweep of the net with the 5-spotted *S. hawaiiensis,* from which it differs also as a larva at least when quite young. Thus, in concentrating on certain groups, one may discover new facts if not new species.

The subject of insects taken at search lights and other lights was briefly discussed.

Mr. O. H. Swezey exhibited some of the butterflies he secured in Guam and on Mt. Maquiling, Luzon, P. I., the latter fauna being much the richer. Other insects were also shown. Mr. Swezey also spoke of the entomologists he had met on his recent trip to the Orient.

Mr. E. C. Zimmerman exhibited and reviewed briefly Prof. H. Osborn's recent book, "Fragments of Entomological History".

Mr. C. B. Keck spoke of the Entomological meeting he attended while on the mainland, the entomologists, the entomological dinner, and spoke of a U.S.D.A. bill in legislature to secure bee inspection against disease for the Hawaiian Islands.

MAY 6, 1937

The 377th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., May 6, 1937, at 2:30 p. m.

Members present: Miss Amy Suehiro, Messrs. Bianchi, Carter, Ehrhorn, Fullaway, Illingworth, McBride, Rosa, Sakimura, Swezey, Van Zwaluwenburg, Williams, and Zimmerman.

Visitor: Foo Kau Lee.

President Rosa called the meeting to order.

The minutes of the preceding meeting were read and approved.

Under the heading of unfinished business, Dr. Walter Carter asked what progress had been made by the committee on publication policy appointed by President Keck at the meeting of October 1936. After a brief discussion further action was deferred until a fuller committee could take it up.

Mr. E. C. Zimmerman presented an obituary notice of Dr. W. M. Wheeler and offered a resolution—seconded and passed—that, on behalf of the Society, the Secretary send Mrs. W. M. Wheeler an expression of condolence.

DR. WILLIAM MORTON WHEELER

It is with regret that the entomologists of Hawaii learn of the death of Dr. William Morton Wheeler at Cambridge, April 19, 1937, shortly after his seventy-second birthday. How unfortunate it is that science must lose such men as he! Dr. Wheeler was a brilliant student, internationally renowned, and a true philosopher. His work has been of fundamental importance, outstanding and unsurpassed; it will live long. His passing leaves a conspicuous, unfilled gap in the world's men of science.

Many of us here in Hawaii have not been fortunate enough to have had personal contact with Dr. Wheeler, but his work has been a constant inspiration and of real value. More than two score of his publications have been devoted to the ants of Oceania.* One of the last papers Dr. Wheeler wrote was upon the ants collected by the Mangarevan Expedition to southeastern Polynesia. His check lists of the ants of Hawaii and of Oceania and his many reports greatly facilitate our work. His irreparable loss is keenly realized by all of us.

PAPER PRESENTED

Mr. E. C. Zimmerman presented a paper entitled: "On Chaenosternum with a Key to the Genera of Hawaiian Cryptorhynchinae (Coleoptera, Curculionidae)".

* See Check List of the Ants of Oceania, B. P. Bishop Mus., Occasional Papers, vol. xi, no. 11, 1935, for an almost complete bibliography.

NOTES AND EXHIBITIONS

Mediterranean fruit fly infesting tomatoes.—Mr. Marlowe submitted the following note (presented by R. H. Van Zwaluwenburg):

On December 4, 1936, 5 mature tomatoes which contained maggots, were collected from a small field of bearing "Break of Day" plants at Kailua. Some female Mediterranean fruit flies were observed on the leaves of the plants during the gathering of the infested material. The tomato field was located approximately 200 feet from bearing papaya trees which was the nearest host of *C. capitata.*

The infested fruit were placed in a tray and held over sand in a tight standard holding box. A total of 64 larvae and pupae were obtained. From these, there emerged 16 melonflies and 10 *C. capitata.* This is the first authentic record of *Ceratitis capitata,* Wied. having been reared from tomatoes infested while growing under natural field conditions. Previous to this time the data available on the infestation of tomatoes by *C. capitata* were those which had been procured from cage tests.

Lema nigrovittata Guerin.—Dr. Illingworth reported that he had found this beetle breeding on Cup of Gold (*Solandra guttata*) at Kaimuki. All stages were present on the leaves, resulting in complete defoliation of the portions of the stems attacked. This Mexican pest was first reported by Mr. N. Krauss, Nov. 2, 1933 (Proc. Haw. Ent. Soc., VIII, 389), in Honolulu, and later March 1934 (Proc. Haw. Ent. Soc., IX, 13), breeding on Angel's Trumpet and Jimson Weed. The eggs are golden yellow, placed in clusters of 6 to 12 on the under side of the leaves. The larvae feed at first only on the lower epidermis, their excrement and dirt piling up on their backs, which appears to be a means of protection from natural enemies. The older larvae eat holes in the leaves, causing them to dry up and fall. When fully fed they enter the soil to pupate. Many adult beetles were found in the same yard feeding on Jimson weed, but no eggs or young were observed on this, which is reported to be their native plant on the Pacific Coast.

Adoretus sinicus Burm.—Dr. Illingworth exhibited a leaf from a Cycad palm, badly eaten by this oriental beetle. A similar emergence occurred last year during April (P.H.E.S. IX, 131). We need more records of the life history of this pest, so observations of damage to such favorite food plants can be used to plot seasonal activity.

Sinoxylon conigerum Gerst.—Mr. Swezey exhibited specimens of this beetle and their work on living twigs of avocado. The material was brought in May 3, 1937, by Sergt. McDole from his residence at 1555 Wilhelmina Rise, Honolulu. The beetles had bored into living twigs and in several places their burrows had practically

severed the wood portion of the twig. It is an unusual habit for this beetle, for it usually attacks injured or severed branches, chiefly operating on the kiawe. One specimen of *Xylopsocus castanoptera* was among the lot.

Bedellia orchilella parasites.—Mr. Swezey reported rearing the following parasites from the sweet potato leaf miner, *Bedellia orchilella* Walsm.: 4 *Secodella metallica* (Ashm.), 13 *Notanisomorphomyia externa* Timb., 2 *Achrysocharis fullawayi* (Crawf.). The material was obtained at the gardens of the Kaneohe Hospital on windward Oahu, April 21, 1937. Certain varieties of sweet potatoes were badly attacked by the leaf miners. Only a small per cent were found to be parasitized by these three eulophids, in the half a dozen leaves brought in. Scores of moths issued.

Orneodes objurgatella Walsm.—Specimens of this moth were exhibited by Mr. Swezey. They had issued in abundance from 154 fruits of *Plectronia odorata* collected by Mr. E. Y. Hosaka at Kaupo, Maui, 25 ft. elevation in a gully near the sea, April 11, 1937. Between April 19 and May 5, 52 moths issued from these fruits, and 21 *Eupelmus* sp. also, which were parasitic on the moth pupae. This is a 44% infestation, and a 28% parasitism. The *Eupelmus* runs to the species *aporostichus* in Perkins' table of *Eupelmus,* but the Maui specimens do not quite agree with the type specimen nor with the description in the Fauna Hawaiiensis; besides, Dr. Perkins' 43 species of *Eupelmus* are each described from a single island, and none from Maui.

Lema nigrovittata Guer.—Mr. Van Zwaluwenburg reported that Mr. Bianchi and he found adults and eggs of this immigrant Mexican chrysomelid on potato plants in Field 58, Oahu Sugar Co., March 23, 1937. On May 1, Mr. Douglas Cooke took numerous adults on "belladonna" *(Brugmansia arborea)* at Black Point, Honolulu. First found on Oahu in 1933, it has apparently spread rapidly on this island, and also occurs on Maui.

Dr. F. X. Williams reported that on his two visits to Mapulehu, Molokai (April 15-16 and 30) he found the immigrant blue damselfly *Enallagma civile* (Hagen) common.

He also found the striped datura beetle, *Lema nigrovittata* Guerin ovipositing on the yellow-flowered *Datura metel* but more particularly on the common *Datura tatula.*

He also mentioned the number of moths that are destroyed when they fly into the illuminated fountain as observed in Thomas Square, Honolulu.

The immigrant water-running bug *Mesovelia mulsanti* was found in the adult stage well in the mossy forest, at about 1750 feet elevation along the Lulumahu stream, Konahuanui. The insect is prevalent in the hot lowlands of Oahu.

Chrysopa lanata Banks.—This immigrant green lace wing, common on the larger Hawaiian Islands, was found on Midway by F. C.

Hadden, who sent in examples to the H.S.P.A. Experiment Station for determination.

Dr. Walter Carter mentioned seeing the common *Pheidole* ant seize *Hambletonia pseudococci,* the recently established South American wasp parasitic on *Pseudococcus brevipes.*

Dr. Carter exhibited under the microscope smears showing individual symbionts in the taro leafhopper (*Megamelus*). He also discussed briefly the mycetom arrangement in leafhoppers, virus, and future studies along these lines.

Mr. D. T. Fullaway exhibited 6 species of the genus *Ecthromorpha* (Ichneumonidae). Twenty-seven species of these wasps are now known. *Ecthromorpha* ranges from Africa, Australia and far into Oceania.

JUNE 3, 1937

The 378th regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., June 3, 1937, at 2:30 p. m.

Members present: Messrs. Bianchi, Bryan, Donaghho, Illingworth, Marlowe, Mason, McBride, Rosa, Sakimura, Swezey, Van Zwaluwenburg, and Zimmerman.

Visitor: F. K. Lee.

President Rosa called the meeting to order.

The minutes of the previous meeting were read and approved.

PAPERS PRESENTED

Mr. Zimmerman presented a paper entitled "Heteramphus of Oahu (Coleoptera, Curculionidae)".

"Stenotrupis of Samoa and Hawaii (Coleoptera, Curculionidae)" was the title of another paper submitted by Mr. Zimmerman.

NOTES AND EXHIBITIONS

Oxacis collaris (Sharp).—Mr. Swezey exhibited specimens of this beetle brought in by Dr. Lyon, who had collected them on the flowers of *Tournefortia argentea* growing in the Ala Moana park. This beetle has usually been taken at lights, often quite abundantly.

Dr. McBride and Mr. Marlowe mentioned the abundance of this oedemerid on corn growing on Quarantine Island a year ago; it was present in large numbers in the silk and on the tassels of the plants, and persisted for several weeks. Mr. Swezey remarked that although this insect is supposedly predacious, definite knowledge of its feeding habits is rather meagre.

Anaphothrips orchidii (Moulton).—Mr. Swezey exhibited specimens of this thrips identified by Mr. Sakimura. They were collected from *Anthurium* at Mr. F. K. Lee's residence, Waikiki, May 16, 1937. Apparently the only other record of this species in Hawaii

is a single specimen collected by Dr. Williams on honohono *(Commelina)* on Mt. Tantalus. Possibly the species is quite common on *Anthurium,* as injured flowers have been noted, and Dr. Lyon has mentioned thrips on anthuriums, but had not brought in any specimens.

Agromyza simplex Loew.—Mr. Swezey exhibited specimens of this fly captured in an asparagus field in the Waimea section of Waialua Agricultural Co., May 18, 1937. Four flies were caught by sweeping with a net, after Mr. Bianchi had found an asparagus stem with a puparium beneath the epidermis in the mine where the larva had fed. After considerable search Mr. Bianchi found another puparium similarly located. Apparently this is the first record of the asparagus miner in Hawaii. An account of the pest in the United States is given by Chittenden in U.S.D.A., Ent. Bul. 66, Part I, 1907. The species was described by Loew in 1869.

Bruchus chinensis L.—Mr. Swezey reported having identified the following parasites handed him by Mr. Sakimura, who had received them from Mr. M. Kurosawa, Yokohama, Japan, where they had issued from *Bruchus chinensis* infesting beans imported from Honolulu, June 20, 1936: *Glyptocolastes bruchivorus* Crawf., *Urosigalphus bruchi* Crawf., and *Heterospilus prosopidis* Vier.

Lema nigrovittata Guerin.—Dr. Illingworth reported this Mexican beetle as a serious pest of angel's trumpet (*Brugmansia arborea*). A garden of these plants at Waikiki was entirely defoliated. Plants of the same kind on Round Top were also attacked with all stages of the breeding beetles on the leaves. The pest was checked by a fog spray of deo-base oil containing pyrethrum of the same strength as used for house spray.

In a discussion of oil sprays which followed, Dr. Illingworth mentioned the successful use by local dairymen against hornfly, of gas oil (specific gravity 32 degrees) to which concentrated pyrethrum extract has been added.

Muscoid Diptera.—Mr. Bryan exhibited part 4 of Dr. C. H. T. Townsend's Manual of Myology. This part gives generic diagnoses of the oestroid flies of the families Dexiidae and Exoristidae. In the latter are classified the genera *Microceromasia, Frontina* and *Chaetogaedia,* species of which are found in Hawaii. Brief mention is made of the value of *Microceromasia sphenophori* as a parasite on the sugar cane beetle borer. Townsend states that "what has been called *Chaetogaedia monticola* is not Bigot's *monticola,* which has the female third antennal joint only a little longer than the second, but is probably *vilis* van der Wulp, or an allied species". In a table of oestroid generic synonymy it is noted that *Ochromeigenia* is a synonym of *Hamaxia* Walker. The other two species of "tachinids" found in Hawaii are noted in part 3 of this series: *Archytas* in the family Tachinidae, and *Leucostoma atra,* as the type of the

genus *Paradionaea,* in the family Gymnosomatidae. *Hamaxia* is placed in the family Oestridae.

New Publications on Pacific Insects.—Mr. Zimmerman called attention to the following papers relating to insects of Oceania, just issued as parts of Volume XIII, Occasional Papers of Bernice P. Bishop Museum:

Check List of the Cleridae (Coleoptera) of Oceania, J. B. Corporaal (vol. xiii, no. 3).

Check List of Neuroptera Planipennia of Oceania, P. Esben-Petersen (vol. xiii, no. 5).

Check List of the Cecidomyidae of Oceania, H. F. Barnes (vol. xiii, no. 6).

On Lea's Fijian Deretiosus (Coleoptera, Curculionidae), E. C. Zimmerman (vol. xiii, no. 7).

JULY 1, 1937

The 379th meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., July 1, 1937, at 2:30 p. m., with President Rosa in the chair.

Members present: Messrs. Bianchi, Bryan, Carter, Illingworth, Marlowe, Mason, McBride, Rosa, Pemberton, Sakimura, Suehiro, Swezey and Zimmerman.

Visitors present: Mr. Chas. Hoyt and Dr. S. W. Wakabayashi.

The President installed Mr. Zimmerman as Secretary pro tem.

The minutes of the previous meeting were read, corrected and approved.

PAPERS PRESENTED

Mr. Zimmerman read a paper entitled "Atelothrus on Oahu (Coleoptera, Carabidae)", and another on "Teleodactylus in the Solomon Islands (Coleoptera, Curculionidae)".

NOTES AND EXHIBITIONS

Mr. Zimmerman exhibited a paratype of his new species of *Atelothrus* from Oahu.

Cerambycobius cushmani Crawf.—Mr. Swezey exhibited specimens of this eupelmid which had issued from pods of *Acacia farnesiana* infested with *Bruchus sallaei* Sharp. The pods were collected June 11, 1937, in the flats near Makapuu Head. Six females and five male parasites had issued from June 14th to 30th. As proof that these were parasites of *B. sallaei,* one male parasite was found to have died when only partially issued from the pod. On opening the pod, one seed was found with an exit hole, and on opening the seed the pupal skin of the parasite was found, as well as the remains of the bruchid larva on which the parasite larva had fed. From the same batch of pods, 174 *Bruchus sallaei* issued and 3 *B. amicus*

Horn. Other parasites which issued were 5 *Heterospilus prosopidis* Vier. and 37 *Urosigalphus bruchi* Crawf. Also quite a number of the egg parasite *Uscana semifumipennis* Gir. One moth, *Argyroploce illepida* (Butler) also issued and two of its parasite *Pristomerus hawaiiensis* Perkins. *Cerambycobius cushmani* is described in Proc. Ent. Soc. Wash., vol. ix, p. 158, 1908. There is also a table separating several species of the genus in the same paper. Mr. Bianchi sent this parasite from Guatemala in 1934 as one of the parasites of the pepper weevil. It has been reared continually at the Board of Agriculture. This is the first knowledge of its having become established here. *Bruchus sallaei* has been listed as one of its hosts at Brownsville, Texas.

Limnastis swaluwenbergi Jeannel.—Mr. Zimmerman reported this small carabid having been taken by Mr. Swezey "on rotten cane seed in ground, field 7, Kahuku, 5-17-28" on Oahu. This is a new distributional note for the species. It has heretofore only been taken by flotation by Mr. Van Zwaluwenburg in soil at the experiment station of the H.S.P.A.

Lema nigrovittata Guerin.—Mr. Swezey and Dr. Wakabayashi exhibited a specimen of this chrysomelid beetle taken by the latter at Waihee, Maui, in September, 1936. It was feeding on eggplant. This is apparently the second record of this beetle on Maui. It was first collected in May 1936, by Mr. Broadbent at Puunene. Mr. Swezey reported for Mr. Noel Krauss that he had found recently severe damage by this beetle on angel's trumpet, *Brugmansia arborea,* in Manoa Valley, the Capitol grounds, and other places, the plants being almost stripped of leaves. A general discussion of the beetle followed.

Insects from "Clipper" planes.—Mr. Pemberton exhibited some insects intercepted on Midway Island by Mr. Hadden from trans-Pacific air liners from the orient. Mr. Hadden sprays the planes at night, and since he has been stationed on Midway the number of insects taken from the planes on arrival at Honolulu has been substantially reduced.

Rhyncogonus of the Mangarevan Expedition.—Mr. Bryan briefly reviewed Bishop Museum Occasional Paper, vol. xiii, no. 11, June 1, 1937, by Dr. Van Dyke in which 39 new species of this weevil genus are described as new from many localities in southeastern Polynesia. The collection of almost 2,500 specimens was collected almost entirely by Mr. Zimmerman.

Mr. Pemberton was called upon by the President for some remarks on his recent expedition to New Guinea and adjacent islands. Mr. Pemberton spoke briefly on his several months' trip collecting wild cane seed in New Guinea, New Britain and New Ireland. Fifty-seven lots of sugar cane seeds were brought back and some of these have already germinated. He had little time to devote

to entomology, but he did collect some interesting specimens which were exhibited including another parasite of the sugar cane weevil.

A general discussion, led principally by Dr. Wakabayashi, of mirid and tenebrionid damage on tomatoes, pepper weevil and gladiolus thrips followed.

AUGUST 5, 1937

The 380th meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., August 5, 1937, at 2:30 p. m. with President Rosa in the chair.

Members present: Messrs. Bianchi, Bryan, Carter, Illingworth, Keck, Mason, McBride, Pemberton, Rosa, Sakimura, Swezey, Timberlake, Van Zwaluwenburg, and Zimmerman.

Visitor: Charles Hoyt.

The minutes of the previous meeting were read and approved.

PAPERS PRESENTED

Mr. Swezey read a paper entitled "Identity of the Nutgrass Armyworm in Hawaii".

Mr. Zimmerman presented a paper "Four New Solomon and Caroline Island Deretiosus (Coleoptera, Curculionidae)".

NOTES AND EXHIBITIONS

Thrips.—Mr. Sakimura stated that the first known case of outdoor infestation by *Hercothrips femoralis* Reuter was found on *Emilia sonchifolia* growing under citrus trees on the grounds of the Pensacola Street Experiment Station. It probably infested the citrus trees, which were not examined.

He also reported that Mr. Fullaway found a large number of thrips on fresh asparagus shipped from San Francisco, on July 8, 1937. The specimens, submitted to Mr. Sakimura for identification, were: *Thrips tabaci* Lind., 13 female specimens; *Frankliniella occidentalis* Perg., 1 male, 3 female specimens. The former species is known to be a transmitting vector of tomato spotted wilt in California. The other transmitting vector of the same disease, *Frankliniella moultoni* Hood, was not recovered from the asparagus.

European earwig (?).—Mr. Swezey exhibited an immature earwig found by Mrs. Swezey in a cavity in a radish, July 9, 1937. Apparently it had eaten the cavity itself, and makes one suspicious of its being the European earwig which is so destructive in Oregon and Washington. He was unable to determine whether the specimen was the young of some local species or not. It is well to be on the lookout for further evidence which might prove the presence of the European earwig.

Opogona purpuriella Sw.—Mr. Swezey reported having reared three moths of this species from larvae in dead asparagus stems at

the asparagus field in Waimea section of Waialua Agricultural Co., May 18, 1937.

Collecting on Kauai.—Mr. Zimmerman told of a three-weeks visit to the Kokee region of Kauai, recently made by Mr. Bianchi and himself. Upwards of 13,000 specimens were obtained, including a *Eupelmus,* the first known from Kauai. Several of Perkins' species, previously known only from uniques in the British Museum, were rediscovered. No trace of the almost fabulous green sphinx moth was seen, although special search for it was made.

Bruchid new to Hawaii.—Mr. Timberlake exhibited a specimen of bruchid taken by him on the ground at Waimanalo Beach, July 14, 1937, which appears to be unlike any of the species present in the H.S.P.A. collection.

Tomato blossom drop caused by midge infestation was reported by Dr. Illingworth. The maggots feed upon the essential organs in the unopened buds. The stamens and pistil are so injured that they darken in color and dry up, and the petals also are usually affected in the same way. Practically all of the buds fall off without opening. The maggots when fully developed leave the buds. They are quite yellow in color and have a habit of skipping which enables them to escape natural enemies and get into the soil to pupate. Maggots of similar habit on tomato were observed by Mr. Swezey, and reported at the meeting of July 5, 1906 (Proc. Haw. Ent. Soc., I, 79). These were determined as *Contarina solani* Rübsaamen. Another species, *C. lycopersici* Felt, has been reported recently doing similar injury to tomatoes in the West Indies (Rev. Appl. Ent., ser. A, xxiii, 713).

Oxacis collaris (Sharp).—Mr. Pemberton reported that thousands of adults of this oedemerid were observed on July 12, 1937, massed together on the under surfaces of leaves of a young coconut palm adjacent to the government road at Niu, Oahu. They were mostly inactive, except when disturbed, when they would quickly take wing. Mating pairs were common. The beetles were not feeding. The tree was again examined on July 27th, when it was noted that the beetles were still present in large quantities, and some were found similarly massed on another coconut tree a few feet away. Females were filled with well-developed eggs. Upon examination on July 30th almost all of the entire assembly had disappeared.

Orchid pests.—Dr. Carter exhibited a larva of *Amorbia emigratella* Busck, a tortricid which causes severe injury to orchids at Woodlawn. He reported further that *Dendrobium taurinum* is an orchid extremely susceptible to injury by an unidentified red spider, while *D. phalaenopsis* is not at all susceptible. A hybrid of the two species proves to be just as susceptible as *D. taurinum.*

Distribution of soil-inhabiting carabids.—Mr. Van Zwaluwenburg's field notes of a survey made some years ago extends the known range of the two small carabids inhabiting Hawaiian soils. *Limnastis swaluwenbergi* Jeannel, the larger, fully-eyed species, has

been recorded from Honolulu (type locality) and Kahuku, Oahu. It was also found in Field 12, Aiea, Honolulu Plantation, Oahu; Field W, Mountain View, Olaa Plantation, Hawaii; and Field 35, Grove Farm, Kauai. Possibly the insect on the other islands is not conspecific with that on Oahu, for at the time differentiating characters were not known; but evidently a bembidine carabid occurs on the outlying islands which is closely related to, if not identical with the *Limnastis* of Oahu.

The smaller, completely eyeless *Typhlonesiotes swaluwenbergi* Jeannel is usually more numerous than *Limnastis*. Besides Honolulu, the type locality, it was found as follows: Field 9, Oahu Sugar Co., and Field 28, Waianae Plantation, Oahu; and Field 35, Grove Farm, Kauai. Another species of similar size, but at the time considered distinct from the Oahu *Typhlonesiotes,* was taken in Field W, Mountain View, Olaa, Hawaii; specimens are not now available, and material will have to be examined before deciding its relationship to the species on Oahu and Kauai.

The President called for a few remarks from Mr. Timberlake, now visiting Honolulu after an absence of some years. Mr. Timberlake told interestingly of his work in building up the collections of the Citrus Experiment Station at Riverside, Calif. He commented upon the large number of species among certain American genera of the bees, and described collecting these insects in southern California. The desert is a particularly good, and apparently inexhaustible, collecting ground for bees, and new species are constantly being found there.

SEPTEMBER 2, 1937

The 381st meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., September 2, 1937, at 2:30 p. m., with President Rosa in the chair.

Members present: Messrs. Bianchi, Bryan, Ehrhorn, Fullaway, Illingworth, Keck, Marlowe, Pemberton, Rosa, Sakimura, Swezey, Van Zwaluwenburg, Williams, and Zimmerman.

Visitors: Charles Hoyt, F. K. Lee, and Miss Ethel Lucas.

The minutes of the previous meeting were read and approved.

Mr. E. H. Bryan, Jr., Chairman of the Committee to Consider Editorial Policy, reported as follows:

It is recommended:

1. That short papers and notes be given preference in the "Proceedings."
2. That preference be given to papers having to do with the economic and taxonomic entomology of Hawaii and related Pacific Island groups. That, in determining the relationship of other regions to Hawaii, consideration be given both to similarity of fauna and crops, and to close connection by regular means of transportation.
3. That the presentation of concise reviews of current publications on the insects of Hawaii, those of related regions, and those of crops which are grown in Hawaii, and of important general works on entomology, be encour-

aged, for the information of members at meetings; but that in publishing the record of such reviews, it be considered sufficient to give only the author, title, reference, and a brief statement as to the scope of the paper.

4. That an Editorial Committee be appointed by the Executive Committee of the Society, with the Editor as chairman, with power to determine what will be published in the Society's "Proceedings", and to attend to other editorial matters. To provide for the appointment of such a committee, the By-Laws of the Society should be revised as follows:

Amend Article 5 by substituting the following for paragraph (e):

"(e) The Executive Committee shall appoint one or more active members from among themselves or otherwise as Librarian, Curator, and Editor, respectively, and two additional members to constitute with the Editor an Editorial Committee which shall determine the policies of publication and all editorial matters."

Committee to Consider Editorial Policy: O. H. SWEZEY, WALTER CARTER, D. T. FULLAWAY, E. H. BRYAN, JR., Chairman.

Mr. O. H. Swezey, as Editor of the Proceedings of the Hawaiian Entomological Society, brought up the question as to whether the authors of papers should be given their title and association. After some discussion it was moved by Mr. Zimmerman and seconded by Mr. Ehrhorn that the editor be instructed to give the authors' titles with articles for 1937, and to leave future action in this matter to the editorial committee. Passed.

PAPERS PRESENTED

Mr. E. C. Zimmerman presented a paper entitled "Emperoptera from Maui (Diptera, Dolichopodidae)".

Mr. E. C. Zimmerman presented a paper entitled "Idotasia in New Ireland (Coleoptera, Curculionidae)".

NOTES AND EXHIBITIONS

Leafmite on *Tithonia*.—Mr. Swezey exhibited foliage of this plant from his garden which was badly injured by a small green leafmite. The new leaves were somewhat crumpled, and were drying at the margins in older attacks.

Mr. F. A. Bianchi stated that the *Agromyza simplex* fly had recently become very abundant on asparagus at Waialua, Oahu.

Mr. C. E. Pemberton said that this fly was parasitized in England by a braconid wasp and a tachinid fly. It occurred also in Germany.

Dr. F. X. Williams exhibited some solitary wasps from California and their prey. The psammocharid wasp *Mygnimia hesperina* Banks preyed upon the "tarantula" *Brachythele longitarsis* Simon, the *Astatus* on certain Heteroptera while members of the genus *Silaon* (sens. lat.) according to species, stored acridiid grasshoppers, certain Heteroptera, and psocids or Corrodentia.

Insect Migration.—Mr. Bryan spoke of meeting Dr. H. L. Richardson, soil chemist at Rothamsted Experiment Station, who had requested that persons having information regarding insect migration should communicate with Dr. C. B. Williams, Chief Entomologist, Rothamsted Experiment Station, Harpenden, Herts., England, who is compiling such data.

OCTOBER 7, 1937

The 382nd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., October 7, 1937, at 2:30 p. m.

Members present: Messrs. Bianchi, Bryan, Chapman, Ehrhorn, Illingworth, Marlowe, Mason, McBride, Sakimura, Swezey, Van Zwaluwenburg, Williams, and Zimmerman.

Visitors: Miss Ethel Lucas, Dr. F. G. Holdaway, and Mr. F. K. Lee.

In the absence of the President and Vice-President, Mr. O. H. Swezey was elected to preside at the meeting.

The minutes of the previous meeting were read and approved.

Mr. E. H. Bryan, Jr., explained the report re the editorial policy for the Hawaiian Entomological Society adopted at the last meeting, and in reference to which he read the proposed amendment to Article 5, of the Constitution by substituting the following for paragraph (e): "(e) The Executive Committee shall appoint one or more active members from among themselves or otherwise as Librarian, Curator, and Editor, respectively, and two additional members to constitute with the Editor an Editorial Committee which shall determine the policies of publication and all editorial matters." Mr. E. C. Zimmerman moved that this amendment be adopted. Seconded by Mr. R. H. Van Zwaluwenburg, and passed.

Mr. O. H. Swezey as Editor of the Proceedings of the Hawaiian Entomological Society announced that Vol. IX, No. 3, was now published.

Mr. E. C. Zimmerman proposed Dr. F. G. Holdaway as a member of the Society. Mr. O. H. Swezey proposed Miss Ethel Lucas as a student member. Following the custom, these two names are to be voted on at the next meeting.

Mr. E. H. Bryan brought up the form of index for Vol. IX of the Proceedings of the Hawaiian Entomological Society and upon which he was working. The subject was considered and reconsidered, and finally it was moved by Mr. Zimmerman and seconded by Mr. Ehrhorn that Mr. Bryan be instructed to arrange it as a general index and a plant index. Passed. A vote of thanks was tended Mr. Bryan for the considerable work involved in indexing this volume.

PAPERS PRESENTED

Mr. Zimmerman presented papers as follows: "The Status of Acalles wilkesii (Coleoptera, Curculionidae)", "A New Fijian Deretiodes (Curculionidae)",* and "Idosaulus, A New Genus of Fijian Cryptorhynchinae (Coleoptera, Curculionidae)".*

OBITUARY NOTE

(Presented by E. C. Zimmerman)

Lord Rothschild, founder and patron of the Zoological Museum at Tring, died on August 27, 1937, at the age of 69 years. The extensive collections and the buildings have been left to the British Museum. Included in this institution are the enormous collection of Lepidoptera built up by Lord Rothschild since his youth, and numbering between one and two million specimens, and the finest collection of Anthribidae in existence. The latter has been developed by Dr. Karl Jordan. The collections will be preserved intact and will not be scattered as has been the fate of many large collections in the past.

NOTES AND EXHIBITIONS

Tapinoma melanocephalum (F.).—Dr. Illingworth reported this ant as a troublesome pest of residences in the drier beach sections of Honolulu. The workers overrun the houses, getting into all kinds of foods, and even get into the beds, where they cause considerable annoyance by biting people. Ordinary control measures, sprays, and dusts have not met the situation. The nests are evidently in the ground but are difficult to locate, being under the buildings. There is very little in the literature concerning this species. It is recorded as the commonest household species in British Guiana, attacking all kinds of foods and dead insects. It is also reported from Cuba associated with a mealy bug on the roots of sugar cane, and as a household pest in Puerto Rico. According to Wheeler this is a tropical Old World species, widely distributed by commerce. It is an abundant Indian ant, and probably originated there, like many of the other insects of the Hawaiian fauna. This is a very tiny ant with a whitish abdomen, the head noticeably dark. This latter character gives rise to the scientific name of the species, *melanocephalum* being Greek for black head.

Argyroploce illepida (Butl.).—Mr. Swezey exhibited a specimen of this tortricid moth reared from seeds of *Pithecolobium dulce*. This appears to be an addition to the list of host plants for this moth in Hawaii.

Catorama mexicana Chev.—Mr. Swezey exhibited this ptinid beetle and some California black walnuts infested with its larvae. He had had a sack of about half a bushel in his basement which had not been disturbed for a year or more. Black dust was noticed on

* Withdrawn for publication by B. P. Bishop Museum.

the floor around it, and on investigation it was found that *Catorama* larvae had eaten the dried outer shucks from the nuts. There were still many larvae to be found, and also living beetles. The first time that he had noticed it infesting walnuts.

Mr. E. C. Zimmerman exhibited interesting pictures of a nest of *Coptotermes formosanus.*

NOVEMBER 4, 1937

The 383rd regular meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., November 4, 1937, at 2:30 p. m.; President Rosa in the Chair.

Members present: Miss Ethel Lucas, Miss Amy Suehiro, Messrs. Bianchi, Bryan, Ehrhorn, Fullaway, Holdaway, Illingworth, Keck, Marlowe, Pemberton, Rosa, Sakimura, Swezey, Van Zwaluwenburg, Williams, and Zimmerman.

Visitors: Ashley C. Browne, and H. D. Kirschman.

Minutes of preceding meeting read and approved.

The Secretary reported that at a meeting of the Executive Committee held just before the present meeting it was moved, seconded, and passed that the bill of $655.68 from the Honolulu Star-Bulletin, Ltd., for printing 500 copies of Vol. IX, No. 3, of the Proceedings of the Hawaiian Entomological Society, be accepted.

Mr. E. C. Zimmerman proposed Dr. Ashley C. Browne for membership in the Society. Following the custom, this name will be voted on at the next meeting.

Dr. F. G. Holdaway and Miss Ethel Lucas were duly elected to membership.

PAPERS PRESENTED

Mr. E. C. Zimmerman presented a paper on "A Key to the Genera of Hawaiian Anthribidae," and discussed the identity of the species. He also presented "A Key to the Lanai Proterhinus." On behalf of Dr. J. R. Malloch, Mr. E. H. Bryan, Jr., presented a paper entitled "Two Genera of Hawaiian Drosophilidae (Diptera)". It included a new genus. Mr. E. H. Bryan, Jr., presented a paper on "A Revised Key to the Hawaiian Drosophilidae, with Descriptions of New Genera and Species." Dr. F. X. Williams presented a paper entitled *"Campsicnemus fumipennis* Parent (Diptera, Dolichopodidae)". Mr. D. T. Fullaway presented a paper entitled "Orchid Insects".

Mr. E. C. Zimmerman presented a paper on "Preliminary Revision of the Fijian Baridinae".*

Mr. D. T. Fullaway presented a paper on "New Species from the Bishop Museum Collection of Parasitic Hymenoptera."

* Withdrawn for publication by B. P. Bishop Museum.

NOTES AND EXHIBITIONS

Tromatobia rufopectus (Cress.).—Mr. Swezey reported having collected 9 of the large egg cocoons from a web of *Argiope avara,* on the Pupukea trail, October 14, 1937. They were of various ages, mostly old ones. From one of them 27 *Tromatobia* issued Oct. 22. The other cocoons when examined were found to contain empty cocoons of *Tromatobia. Argiope* egg cocoons are seldom found any more, due to the prevalence of *Tromatobia* whose larvae destroy so many of the eggs.

Aplastomorpha calandrae (Howard).—Mr. Swezey reported having reared this parasite from the bookworm *Catorama mexicana,* several of them having issued from the black walnut material exhibited at the previous meeting which was badly infested with this beetle. This is apparently the first record in Hawaii of this parasite being reared from this beetle as a host.

Amyosoma chilonis Viereck.—Mr. Swezey exhibited a specimen of this rice borer parasite which had issued from a stool of rice badly damaged by rice borer, *Chilo simplex* (Butl.), from Waipa, Kauai, brought in by Mr. King, Sept. 28, 1937. It is the first recovery of this introduced parasite from the island of Kauai. Mr. Fullaway has reported its recent recovery on Oahu. The report of its having become established several years ago, was in error. The species reported at the time is now known to be a different still-undetermined species from Japan. *Amyosoma chilonis* was introduced from China in 1928.

Dr. F. X. Williams exhibited nests of a leaf cutter bee from Mapulehu, Molokai. They varied from less than one to nearly 2 inches in length and instead of being constructed within some shelter, as a hole, crack, leaf-frond fold, etc., lay exposed on the upper edge of the door and window casing of the quarantine greenhouse. The casing boards were about $\frac{5}{8}$" thick and 3 inches under the eaves. The nests in many cases lay along the boards' edge, or rose from it at an angle and were not very strongly cemented down.

Mr. E. H. Bryan, Jr., exhibited a collection of drosophilid flies.

Mr. D. T. Fullaway exhibited a specimen of the hydrophilid beetle *Sphaeridium scarabaeoides,* which he had recently taken on windward Oahu. A short time thereafter Mr. C. E. Pemberton caught a second specimen. This common European species now widely spread was introduced here in 1909 as a possible hornfly enemy, by Albert Koebele.

Mr. C. B. Keck exhibited a bee hive raised some 18 inches from the ground by 4 iron rods, and provided with a wire screen apron in front so as to prevent *Bufo marinus* from getting at the bees.

Mr. F. A. Bianchi exhibited on behalf of Mr. C. E. Pemberton and himself, some potato "seed" from Oahu Sugar Co., Ltd., plantation, that had been slightly damaged by the tenebrionid beetle larva

Gonocephalum seriatum (Boisd.). The "seed" had been treated with bichloride of mercury.

On being called upon for a talk, Dr. A. C. Browne of the University Agricultural Extension Service spoke of the growing development of vegetable crops and their importance and problems.

Dr. Holdaway then responded, explaining his dual role in work —with the Entomology Department at the University and the Experiment Station there. He commented on the scarcity of entomological material for student class work and stated that any assistance here would be very welcome.

DECEMBER 3, 1937

The 384th meeting of the Hawaiian Entomological Society was held at the Experiment Station, H.S.P.A., Honolulu, December 3, 1937, at 2:30 p. m., with President Rosa in the chair.

Members present: Miss Ethel Lucas, Miss Amy Suehiro, Messrs. Bianchi, Browne, Bryan, Ehrhorn, Holdaway, Illingworth, Ito, Keck, McBride, Mason, Pemberton, Rosa, Sakimura, Schmidt, Swezey, Van Zwaluwenburg, Williams, and Zimmerman.

Visitors: Dr. S. A. Graham, Mr. F. K. Lee.

The minutes of the previous meeting were read and approved.

Dr. F. X. Williams read the Treasurer's report for the year ending December 1, 1937. The cash on hand was $172.36. The report had been approved at the meeting of the Executive Committee held just prior to the present meeting. It was moved that this report be accepted and filed—subject to auditing. Seconded and passed. The chair appointed Mr. A. C. Mason as auditor.

Dr. A. C. Browne was duly elected to membership in the Society.

The following officers were elected for 1938:

President: Dr. Carl Schmidt

Vice-President: F. A. Bianchi

Secretary-Treasurer: Dr. F. X. Williams

Additional members of the Executive Committee: E. M. Ehrhorn and R. H. Marlowe.

Mr. R. H. Van Zwaluwenburg moved that a vote of thanks be extended Mr. O. H. Swezey, editor of the "Proceedings" for his editorial work—from 1905 to 1937. Seconded and passed. Mr. Swezey responded to the vote in fitting terms.

Similarly Mr. E. H. Bryan, Jr., was given a vote of thanks for getting out the index of the "Proceedings".

PAPERS PRESENTED

Mr. Kay Sakimura presented a paper by title: "Notes on Thrips on Kauai".

Dr. O. C. McBride presented a paper on behalf of Donald Starr and Kam Hu Lau, entitled: "Cyclohexylamine, an Attractant for *Lathryophthalmus arvorum* (Fabr.)".

On behalf of Mr. R. L. Usinger, Mr. O. H. Swezey presented a paper entitled: "Biological Notes on the Pelagic Water Striders (Halobates) of the Hawaiian Islands, with Description of a New Species from Waikiki (Gerridae, Hemiptera)".

Mr. O. H. Swezey presented a paper entitled: "Host Plant Records of the Species of Proterhinus (Col.) in Hawaii". Mr. Swezey exhibited specimens of these beetles.

Dr. F. X. Williams presented by title two papers as follows: "*Asyndetus carcinophilus* Parent, a Maritime Dolichopodid Fly".

"Biological Studies in Hawaiian Water-Loving Insects: Part III; Diptera; A, Anthomyidae and Ephydridae".

Mr. E. C. Zimmerman presented papers as follows: "A Second Species of Elytroteinus (Coleoptera, Curculionidae)"; "Orochlesis in the Solomon Islands (Coleoptera, Curculionidae)".

NOTES AND EXHIBITIONS

Mr. R. H. Van Zwaluwenburg presented some interesting data by Mr. Hugh Brodie on *Chalcolepidius erythroloma* Candeze: Since June 1st, Mr. Hugh Brodie has had an adult of this immigrant South American elaterid beetle (age unknown), which has become more or less of a family pet. "Click" crawls without hesitation onto the extended hand of members of the household, but refuses to accept strangers. Kept in a large bowl, it sometimes gets out by flying or leaping, but makes no effort to hide or to escape from the house. It feeds frequently and with gusto on any of the local fruits except citrus and pineapple; papaya has been its main diet. Its claws becoming dirty with accumulations of food, the insect was recently subjected to a bath, which it survived but showed no evidence of liking. The readiness with which a purple plush elephant is climbed, suggested at first a seeming color preference which now appears to be without significance; the beetle crawls aimlessly over this elephant for hours at a time without trying to leave it. "Click's" leaps from a supine position are becoming less and less vigorous, and it seems likely that it is approaching the end of an existence which, to an elaterid, probably seems sybaritic.

Haplogonatopus vitiensis Perkins.—Mr. Swezey exhibited this dryinid which he had reared from the taro leafhopper, *Megamelus proserpina* Kirk., 52 cocoons having been collected on taro leaves at Kokokahi, Oahu, Oct. 29, 1937. From these cocoons 31 female dryinids issued Nov. 4-9. Later examination revealed 5 dead adults and 2 dead larvae in cocoons—a total of 38 of the 52 cocoons. From the other 14 cocoons 38 hyperparasites, *Helegonatopus pseudophanes* Perkins, had issued, equal to a hyperparasitism of 27%. Mr. Swezey reported having reared the same dryinid from the taro leafhopper in Guam in 1936, and that the hyperparasite attacking it there was *Echthrogonatopus exitiosus* Perkins.

Thripoctenus brui Vuillet.—Mr. Swezey reported that the thrips

parasite which he recorded from *Thrips tabaci* Lind. on nasturtium, on page 361 of "Proceedings" Vol. IX, had been studied by Mr. Sakimura and found to be *Thripoctenus brui* which was introduced from Japan in 1934.

Pinnaspis buxi (Bouché).—Dr. Illingworth brought in some leaves of *Monstera deliciosa* that had been heavily infested by this scale for the past two months. Two species of lady-bird beetles fed on this scale and made a thorough cleaning-up. These are *Chilocorus circumdatus* Schon. and *Sticholotis punctata* Crotch. This scale is also found on coconuts.

Xyleborus kraatzi Eichh.—Dr. Illingworth reported an extensive flight of this scolytid beetle at Kaimuki. On the evening of Nov. 2, 1937, the air was filled with hundreds of the flying insects, so small that they came in through the screens.

Eutochia lateralis (Boh.).—Mr. Pemberton presented a note on this tenebrionid beetle which normally breeds in rotting trash, decomposed manure and compost heaps. During November, 1937, it appeared in enormous numbers in the soil in a young field of "plant" sugar cane at Ewa, Oahu, and severely damaged the germinating shoots of cane "seed pieces" by eating holes in the tender growing tissue and sometimes completely cutting them off. The damage was caused by the adult beetles. During several months previously this field had been manured with heavy applications of Oliver filter mud, a sugar mill by-product, in which the insect had readily bred and accumulated prior to the planting of the cane cuttings. Such massing of the species in cane fields has not been previously noted, though it can usually be found in moderate quantities in rotting cane trash.

Laphygma exigua (Hbn.).—Dr. Browne reported having collected larvae of this noctuid on Nov. 10, 1937, at Kahala, Oahu, which were feeding inside the hollow stems of green onions. The crop was about 25% destroyed. No parasites were reared out when caged material was held for observation. He had also observed the "white fly" *Trialeurodes vaporariorum* abundant recently on strawberries at Wahiawa—a new host record.

Dr. F. G. Holdaway stated as a matter of interest that *Encarsia* sp., a parasite on this "white fly" in England, is shipped regularly to greenhouses in Tasmania, New Zealand, etc.

Dr. F. X. Williams exhibited an ephydrid fly identified by E. T. Cresson, Jr., as *Hecamede persimilis* Hend. This makes the second named species of the genus in the archipelago. It is a beach species that is often associated with the burrows of the "ghost crab", *Ocypode ceratophthalma* (Pallas).

Dr. Schmidt introduced Dr. S. A. Graham, Forest Entomologist at the University of Michigan, who spoke briefly on his present visit to Honolulu. Dr. Schmidt also gave a short talk on his recent trip to Brazil.

Key to the Hawaiian Drosophilidae and Descriptions of New Species

BY EDWIN H. BRYAN, JR.
Curator of Collections, Bernice P. Bishop Museum.

(Presented at the meeting of November 4, 1937)

In 1933[1] the writer enumerated 58 species of flies of the family Drosophilidae which had been recorded from Hawaii, including five species and a variety which were at that time described as new. Since then one additional species has been recorded from Hawaii, one new genus and species is described and another recorded by Dr. J. R. Malloch in these Proceedings (page 53), and three new species are described below, bringing the total up to 64 described species. These represent seven or eight genera.

In 1923-1924, in connection with graduate work for an advance degree at the University of Hawaii, the writer prepared keys to many of the families, genera, and species of Hawaiian Diptera. The great increase in the knowledge of this order in Hawaii has made the publication of this manuscript[2] seem inadvisable, without extensive revision. The portion of the keys which has to do with the family Drosophilidae has at this time been revised and is here presented, together with descriptive notes, with the hope that it may aid in the identification of this interesting group of flies. As Diptera nomenclature is somewhat specialized, a brief diagnosis of the characters of chief taxonomic importance, for this family, is given.

Drosophilidae are small acalypterate flies, rarely exceeding 5 or 6 mm. in length, many much smaller. Some members of the genus *Idiomyia* here reach a length of 7 mm. Many of the species found in Hawaii have strikingly pictured wings. All but one species have a plumose or pectinate arista on the third segment of the antenna. The face is nearly vertical in profile, with bristles, in a characteristic arrangement, on the upper half of the front. The typical venation of Drosophila is shown in figure 1. The costal vein is twice broken before the tip of the 1st longitudinal vein, which appears to continue as the costa. The auxiliary vein is rudimentary. In none of the species found in Hawaii is there a cross-vein separating the discal and second basal cells.

Some species are found about decaying vegetable matter, such as fermenting fruit, garbage, and the like. Other species occur in the native forest, attracted to exuding sap and rotting bark. Two of the introduced species in Hawaii are predators, one on spiders' eggs and one on mealybugs. The group is world wide in distribution; some are popularly known as "pomace flies"; and, because of

[1] Bryan, E. H. Jr., A review of the Hawaiian Diptera. Hawaiian Ent. Soc., Proceedings, vol. VIII, no. 3, July, 1934. (Drosophilidae, pp. 434-440, 456-457.)

[2] Bryan, E. H. Jr., Diptera of Hawaii. (Manuscript). 1924.

their short life cycle and large chromosomes, some have been used extensively in the study of inheritance.

EXTERNAL STRUCTURES OF TAXONOMIC VALUE

HEAD: On each side of the *front* (space between the eyes, from base of antennae to vertex, or top of head) is a row of 3 *fronto-orbital* bristles: in typical Drosophila the uppermost is directed toward the apex (reclinate), the middle one is smaller than the other two and also reclinate, and the lower one is directed toward the mouth cavity (proclinate) and is a little further from the eye-margin than are the other two. The *ocelli* are three small, simple eyes, one in front and two behind, situated at the top of the front, in a well-marked *ocellar triangle*. A single pair of *ocellar bristles* stand on the front, one just in front of each lateral ocellus, always directed outward (divergent). A single pair of *postvertical bristles* stand just behind and laterad to the lateral ocelli, directed toward each other (convergent). Two *vertical bristles* stand on each side, at the upper lateral corners of the front, the outer pair divergent, the inner pair convergent.

The antennae are each composed of 3 segments, the basal short, the second somewhat longer and crowned with hairs of short bristles, and the third as long or longer than the other two combined, bearing a slender *arista* or two-jointed, bristle-like appendage, which in most of the species is plumose, with dorsal, hair-like branches spaced along its entire length, and ventral branches on the outer portion only. The arista may also be pectinate (with branches, like a comb, on one side only), or minutely pubescent (in one species).

Below the antennae and above the oral margin is the *face,* which may have a central elevated ridge or keel (*carina*), running down from between the antennae. The *vibrissae* are a pair or row of bristles at the outer corners of the oral, buccal, or mouth cavity, and along its anterior (upper) edge.

The eyes may be bare or hairy; if hairy, with a minute hair at alternate angles of the hexagonal ommatidia, of which there may be several hundred. In Chymomyza there is an area of enlarged ommatidia in the lower anterior part of the eyes.

THORAX: The number and arrangement of bristles is of most taxonomic value. The *mesonotum* of Drosophila bears: 2 conspicuous pairs of *dorsocentral bristles,* on its median posterior part, directed backward toward the scutellum; between these are rows of *acrostical hairs;* a large and a small pair of *postalar bristles,* laterad from the posterior dorsocentrals, and above the middle of the wing base, the small one toward the scutellum from the large one; a large and a small pair of *supra-alar bristles,* laterad from the anterior dorsocentral, and above the anterior edge of the wing base, the smaller anterior to the larger; a single pair of *presutural bristles,*

above and behind the humeral angles; each humeral angle may bear from one to three bristles; behind the humeral angle, and laterad from the presuterals, are two *notopleural bristles* on each side, just above the notopleural suture. The margins of the scutellum may have one or two pairs of strong bristles.

LEGS: The coxae are much longer on the first pair of legs than on the other two. On the tibiae there may be prominent *apical* and *preapical bristles,* located on, or just before the outer end. In some species the male may have special hairs or bristles located upon the legs, especially the front pair, which are not found on the female, such as a comb-like row of about ten short, stiff, slightly curved, black bristles on the inner distal surface of the basal tarsal joint (metatarsus), found in *Drosophila melanogaster,* the common, small pomace fly. The male also may have the two basal joints of the front tarsi shorter and thicker than the corresponding joints of the other legs; while in the female corresponding tarsal segments are alike in size and shape.

WINGS: The nomenclature of the wing venation, as used in these keys and descriptions, is shown in figure 1. The following "index" relationships are used by taxonomists: The sections of the costa are numbered outward from the base,—that between the base and the tip of the 1st vein is the first section (A); between the tips of the 1st and 2nd veins, the second section (B); between the tips of the 2nd and 3rd veins, the third section (C), etc. The length of the second section divided by the length of the third section (B/C) is called the *costal index.* Sections of the other longitudinal veins are likewise numbered from the base, assuming all cross-veins to be present. The portion of the 4th vein lying between the anterior and posterior cross-veins is called its third section (E); the distal section of the 4th vein is called the fourth (F). The length of the fourth section of the 4th vein divided by the length of the third section (F/E) is called the *fourth-vein index.* The length of the third section of the costa divided by the length of the third section of the 4th vein (C/E) is called the *4 C index.* The length of the distal section of the 5th vein (G) divided by the length of the posterior cross-vein (X) is called the *5 X index* (G/X). The costa is edged with a row of short hairs, a double row on the first section, in which are situated the two "breaks," and a single row beyond. The surface of the wing may also be covered with pale hairs, so fine as to be visible only under some magnification.

ABDOMEN: The sexes may be most readily distinguished by examining the abdomen. The females have six or seven segments, the males five. Each of these segments is composed of a curved, chitinized *dorso-lateral plate,* connected by a parchment-like area, on each side, with a quadrilateral-shaped *ventral plate.* Of the latter there are six in the female and four in the male. Each plate overlaps the anterior portion of the one further out.

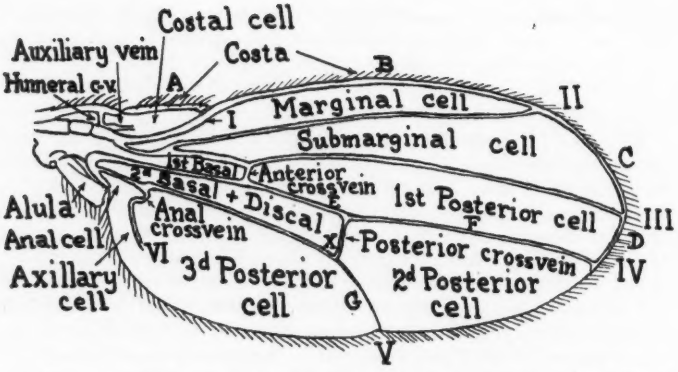


Fig. 1. Wing of *Drosophila melanogaster* (after Sturtevant), with the venation nomenclature used in these keys and descriptions. The following tabulation will help to correlate various systems of names for veins and cells:

	VEINS	Comstock & Needham
Costa,	Costal or Marginal Vein	C Costa
Auxiliary,	Auxiliary Vein	Sc Subcosta
I	1st Longitudinal Vein	R_1 Radius 1
II	2nd Longitudinal Vein	R_{2+3} Radius 2 plus 3
III	3rd Longitudinal Vein	R_{4+5} Radius 4 plus 5
IV	4th Longitudinal Vein	M_{1+2} Media 1 plus 2
V	5th Longitudinal Vein	$M_{3+4}+Cu_1$ Media 3 plus Cubitus 1
VI	Anal Vein	Cu_2+1st A Cubitus 2 plus 1st Anal
	CROSS-VEINS	
	Humeral cross-vein	h Humeral cross-vein
	Anterior cross-vein	r-m Radio-medial cross-vein
X	Posterior cross-vein	m Medial cross-vein
	Anal cross-vein	Cu_2 Cubitus 2
	CELLS	
	Costal Cell	1st+2nd C (Two costal cells separated by h)
	Marginal Cell	1st R
	Submarginal Cell	3rd R
	1st Basal Cell	
	1st Posterior Cell	R_5
	2nd Basal + Discal Cell	M+1st M_2
	2nd Posterior Cell	2nd M_2
	3rd Posterior Cell	Cu_1
	Anal Cell	Cu
	Axillary Cell	A

INDEXES	
Costal index,	$\frac{B}{C}$
4th Vein index,	$\frac{F}{E}$
4 C index,	$\frac{C}{E}$
5 X index,	$\frac{G}{X}$

In the female, behind the 7th (or 6th) dorso-lateral plate, is a papilla, composed of a long-haired dorsal and a smaller ventral chitinized plate, forming the anal opening. Below this is the ovipositor, which may have a variety of forms. In the male, behind the 5th dorso-lateral plate, is a small plate called the *genital arch,* connected with the 5th segment by an obscure plate. Below and behind these is a chitinized plate, called a *clasper,* bearing peg-like bristles. Above, on each side of the anus, is a hairy, upright *anal plate,* which lies vertically, instead of horizontally, as in the female. The form and manner of articulation of these various parts (together called the *hypopygium*) is characteristic in different species, and might be used in taxonomy, although often difficult to see. As they have been disregarded in past descriptions of Hawaiian species, and as so few of the native species are represented in local collections, they cannot be used in these keys.

KEY TO THE GENERA IN HAWAII

1. Mesonotum with four series of fine acrostical hairs between the pairs of dorsocentral bristles, which are postsuteral and two in number; length 1.5 mm.....2
1′. Mesonotum with six or more rows of acrostical hairs; length more than 1.5 mm.....3
2. White-dusted broad vitta extends along dorsum from front to apex of scutellum; arista of antennae with four strong rays above and none below; wings grayish hyaline, clouded at the fork of 2nd and 3rd veins and over cross-veins, and with three dark spots equally spaced in marginal cell, along the costa and one on middle of last section of 4th vein.....**Tantalia albovittata** Malloch*
2′. Thorax shining black with two gray-dusted vittae on mesonotum, one on each side behind the suture, and two on each pleura; arista with six rays above and three below; legs black with yellow rings; wings dark with hyaline spots.....**Dettopsomyia formosa** Lamb**
3. Arista minutely pubescent; front rather hairy.....4
3′. Arista plumose.....5
3″. Arista short pectinate (branches on upper side only); eyes hairy; no prescutellar bristles, but other bristles large.....**Titanochaeta**
4. Costa weak between tips of 3rd and 4th veins; wings clear; thorax and abdomen concolorous, cinereous, marked with brown.....**Gitona**
4′. Costa well developed to apex of 4th vein; wings with cloudy infuscation.....**Pseudiastata**
5. An extra cross-vein between 3rd and 4th veins near posterior cross-vein.....**Idiomyia**
5′. Only one (the anterior) cross-vein between 3rd and 4th veins.....6
6. Lower reclinate orbital bristle large, placed below the proclinate on the front; postvertical bristles small; eyes bare or nearly so, some ommatidia in the lower anterior part enlarged.....**Chymomyza**
6′. Lower reclinate orbital bristle small, placed above (or rarely a trifle below) the proclinate.....7

* Described by Dr. J. R. Malloch in these Proceedings, page 53.
** Redescribed by Dr. J. R. Malloch on page 54.

7. Lower angles of face with a conspicuous row of strong black bristles, which curve forward, extending back from the vibrissae; four supra-alar bristles ..... **Hypenomyia**

7'. Face without such conspicuous black bristles below the vibrissae, along the oral margin only; two supra-alar bristles present..... **Drosophila**

TITANOCHAETA Knab, Insecutor Inscitiae Menstruus, II, p. 168, 1914.

Titanochaeta ichneumon Knab is a very small (2 mm. long), dark brown fly, with pale gray-pruinose dorsum and front, slender, pale yellow legs, and very long, black inner vertical bristles. The arista is short pectinate, as indicated in the key. It has been reared from spider's eggs. The wing indices are as follows: costal index, 2.1 to 2.6; 4th vein index, 2.0 to 2.1; 4 C index, 1; 5 X index, 2.8.

GITONA Meigen, Systematische Beschreubung der bekannten europäischen zweiflügligen Insekten. 6, 129, 215, 1830.
(Gitonides Knab, Insecutor Inscitiae Menstruus, II, p. 165, 1914.)

Gitona perspicax (Knab) is a small (3.5 mm.) pale gray-pruinose fly, with red-brown blotches; abdomen banded red-brown and yellow; wings clear with pale brown veins; costal index, about 2.6; 4th vein index, 1.75 to 2.1; 4 C index, 1 to 1.1; 5 X index, .9 to 1.1. It is a parasite on mealybugs (Pseudococcus spp.), widely distributed in S. E. Asia and tropical Australia. In Hawaii it has been bred from mealybugs infesting sugar cane and other plants.

PSEUDIASTATA Coquillett, Proceedings, Entomological Society of Washington, vol. 9, p. 148, 1908.

Pseudiastata nebulosa Coquillett. Although this species is by some authorities placed in a separate family, Diastatidae, it is included in this key because of its close relationship. It is a robust little fly with a flattened, hemispherical head; the front, thorax and abdomen are uniformly light cinereous-brown, with bristles of the same color; the wings with one large and two smaller, cloudy infuscations; two conspicuous black bristles just before each costal break; costal index, 5.3; 4th vein index, 1.0; 4 C index, .38; 5 X index, .5. Several of these flies have been introduced from Panama, as parasites on the pineapple mealybug; but it is not known to be established in Hawaii.

IDIOMYIA Grimshaw, Fauna Hawaiiensis, III, p. 50, 1901.

This genus contains the largest of the Hawaiian Drosophilidae, some up to 7 mm. long. Its species are distinct from all other members of the family in having an additional cross-vein connecting the 3rd and 4th longitudinal veins, located near the posterior cross-vein. There are, in local collections, specimens of only three of the seven described species, but an attempt is made below to separate them in a key drawn up from descriptions.

1. Wings appearing brown, with numerous small hyaline spots in the cells.....**I. grimshawi** Bryan
1'. Wings with various fuscous marks, at tip, along cross-veins and parts of the 4th vein, and, in some species, in marginal cell and at base of wing 2
2. Scutellum entirely dark on disc; front yellow to golden on the anterior part, black across the vertex, through the ocellar triangle.....3
2'. Scutellum with a light median stripe; front yellow or reddish-yellow, without a continuous black band across the vertex, although the ocellar triangle and upper half of the orbits may be black.....5
3. Mesonotum light on the anterior half, with two distinct medial brown lines, and a brown spot on each side; scutellum dark, bordered with yellow 4
3'. Mesonotum light, with brownish infuscation lacking definite pattern; scutellum entirely dark, not bordered with yellow; abdomen black, paler at base; pleurae nearly black; proboscis and palpi yellow.....**I. silvestris** Perkins
4. Proboscis and palpi yellow; abdomen black with a series of yellow spots on the sides; two medial brown stripes cross anterior half of mesonotum, some yellow on posterior half; pleurae with 3 or 4 dark spots.....**I. heteroneura** Perkins
4'. Proboscis and palpi black; abdomen entirely shining black; posterior half of mesonotum dark brown, with two medial brown stripes extending a short way forward into its anterior half, which, like the pleurae, is dark cinereous-yellow.....**I. picta** Grimshaw
5. Face, antennae, and palpi black; front with a transverse brown band behind base of antennae; mesonotum black with yellow anterior edge or lines.....6
5'. Face and palpi yellow; antennae obscurely reddish-yellow, 3rd segment with brown pile; front yellow or dusky-yellow, without a transverse brown band behind the antennae; mesonotum reddish-yellow, with two dark brown stripes, which are hook-shaped, and broad posteriorally.....**I. oahuensis** Grimshaw
6. Mesonotum with a yellow median stripe; femora with only the bases and tips infuscated; costa strongly arched (only the ♂ is known).....**I. perkinsi** Grimshaw
6'. Mesonotum entirely black; femora black with yellow tips; costa nearly straight (only the ♀ is known).....**I. obscuripes** Grimshaw

Idiomyia grimshawi Bryan.

Two male specimens, which agree reasonably well with this species, were collected by Dr. F. X. Williams at Lulumahu Valley, Oahu, one at 1900 feet elevation, Sept. 27, 1936, and one on banana plants, May 2, 1937. These differ somewhat from the type, which was a female, in being darker, with browner wings, having a slightly different arrangement of hyaline spots. The central brown stripe of the mesonotum fades out at about its middle, being distinct only on the posterior half and across the scutellum. There is much variation in color, however, among specimens of these species; and until many more specimens are available for comparison, all of those with brown wings containing hyaline spots, will be considered as belonging to one species. The four wing indices of these two specimens, together with those of the type, are as follows:

Specimen and wing		Costal index	4th vein index	4 C index	5 X index
Type, ♀,	Left wing:	5.6	1.04	.36	.96
	Right wing:	5.6	1.03	.36	.87
Lulumahu, ♂,	Left wing:	6.1	.98	.31	.66
	Right wing:	6.4	1.00	.31	....
Lulumahu, ♂,	Left wing:	6.3	.96	.31	.79
	Right wing:	6.4	.96	.29	.79

Idiomyia oahuensis Grimshaw

Five specimens which were collected by Dr. F. X. Williams at Lulumahu Valley, Oahu, in a banana grove, 1800 to 1900 feet elevation, Sept. 19-27, 1936, and April 4 and 11, 1937, are assigned to this species. They differ from Grimshaw's description only in minor respects. The type was a female. Male specimens in this series have the costa arched, just beyond the juncture of the first vein. In describing *Idiomyia obscuripes,* based on two female specimens with straight costa, Grimshaw notes its close relation to *I. perkinsi,* described from a male specimen, which has a strongly curved costa, suggesting that it may be only the female of that species. The finding of this sexual difference in *I. oahuensis* strengthens this supposition, although they may still be opposite sexes of distinct species, as one came from Molokai Mts. and the other from Haleakala, Maui, and there are also minor differences, such as the color of the legs.

The indices of Dr. Williams' five specimens from Lulumahu, and also those of one female specimen, collected by O. H. Swezey on Mt. Olympus, Oahu, 10-20-1918, in nest of *Hylocrabro tumidoventris,* are as follows:

Specimen and wing		Costal index	4th vein index	4 C index	5 X index
Mt. Olympus, ♀,	Left wing,	5.32	1.02	.37	.44
(Swezey)	Right wing,	5.14	1.04	.39	.55
Lulumahu, ♀,	Left wing,	4.98	1.0	.35	.41
Sept. 19,	Right wing,	4.19	1.0	.45	.40
Lulumahu, ♀,	Left wing,	4.91	.92	.37	.48
Sept. 20,	Right wing,	4.73	.95	.40	.42
Lulumahu, ♀,	Left wing,	5.31	1.0	.37	.36
Sept. 27,	Right wing,	5.48	.96	.37	.36
Lulumahu, ♂,	Left wing,	4.96	.92	.36	.32
Apr. 4,	Right wing,	4.93	.89	.37	.33
Lulumahu, ♂,	Left wing,	4.35	.85	.40	.33
Apr. 11,	Right wing,	4.81	.85	.36	.35

In the female specimens the extra cross-vein between the 3rd and 4th veins is almost continuous with the posterior cross-vein. In the males these two are separated by about 1/6 the length of the extra cross-vein or 1/13 the length of the posterior cross-vein, the latter being toward the apex.

A single female specimen collected by O. H. Swezey on the Kaala Mts., Oahu, 9-7-1913, is related to this species, but is larger (7 mm. long, wing 8 mm.), the proboscis is lighter brown, the 2nd antennal segment has fewer brownish and blackish bristles and hairs, the mesonotum is darker, without definite edge to the dark stripes, and the scutellum is all dark, with only a faint trace of lighter medial line. The indices for its wings are as follows:

	Costal index	4th vein index	4 C index	5 X index
Left wing:	5.67	1.06	.37	.57
Right wing:	5.89	1.03	.35	.52

Idiomyia picta Grimshaw

An examination was made of a single female paratype specimen in B. P. Bishop Museum, collected on Haleakala, Maui, 5000 feet elevation, Oct., 1896, by Dr. R. C. L. Perkins. Its bright, golden-yellow front is bordered across the vertex by a black band, including the upper orbits and ocellar triangle, W-shaped, as viewed from behind. The extra posterior cross-vein is about .4 to .45 its own length beyond the posterior cross-vein. The wing is infuscated across both posterior cross-veins, the last section of the 5th vein, the adjacent portion of the penultimate section of the 4th vein, the tips of the 2nd, 3rd, and 4th veins, and across the apical portion of the costal cell to the 3rd vein, at the anterior cross-vein. The wing indices are:

	Costal index	4th vein index	4 C index	5 X index
Left wing:	5.0	1.25	.43	.69
Right wing:	5.33	1.3	.40	.69

CHYMOMYZA Czerny, Zeitschrift fur Hymenopterologie, Dipterologie, 3, p. 199, 1903.

Chymomyza procnemis (Williston)

Specimens collected in pineapple fields at Kunia, Oahu, Nov. 10, 1936, by K. Ito, and Dec. 16, 1936, by Dr. Walter Carter, were identified as this species. They are small flies, about 2 mm. long. The front is golden yellow, the orbits smooth and dark brown. Thorax is chocolate brown; abdomen black. Legs light, except the front tibia, femora, and metatarsus, which are black and bristly; the hind metatarsi are also minutely bristly, but are yellow. Wings clear, costal vein strong and black, until just before its juncture with the 3rd vein, when it becomes white; other veins pale brown.

Costal index, 1.3 to 1.6; 4th vein index, 2.3 to 2.6; 4 C index, 1.5 to 1.6; 5 X index, 2.8 to 3.4.

HYPENOMYIA Grimshaw, Fauna Hawaiiensis, III, p. 53, 1901.

Sturtevant[3] placed this genus as a "synonym of Drosophila, in the absence of a satisfactory description." There are no specimens in Hawaii of the single species, *H. varipennis* Grimshaw. The writer has no assurance that it is either a good genus or correctly diagnosed in the key to genera given above.

DROSOPHILA Fallen, Diptera Sueciae Geomyzides, 2, 4, 1823.

This is the largest genus of Diptera in Hawaii. Dr. R. C. L. Perkins[4] estimated that not less than 250 species would eventually be found. Sufficient collecting has not been done to adequately treat this group. Many of the 41 endemic species which Grimshaw described were based upon only one or two specimens. Representatives of but few of these species have been captured since, so that the group is very poorly represented in local collections. This, coupled with the meager descriptions and the extreme variability in the group, makes the identifying or characterizing of specimens very difficult and unsatisfactory. Four immigrant species are known to occur in Hawaii, which are much more abundant than the native species. There may be other species here which will be found elsewhere, on other Pacific islands, if not on the continents. The following key is based largely upon descriptions, and for that reason may be subject to revision when more specimens are procured.

KEY TO THE SPECIES OF DROSOPHILA IN HAWAII

1 . Wings with a dark pattern, including fuscous spots in the cells.....2
1'. Wings infuscated only at apex, in costal cell, or along the veins.....14
1". Wings not infuscated (they may be uniformly dusky or tinged with yellow) 30
2 . Thorax light colored, with a single broad, central dark stripe and conspicuous lateral spots 3
2'. Thorax without such markings.....5
3 . Tibiae pale yellow, conspicuously banded with dark brown; antennae blackish, 3rd segment yellow on lower half and at apex; wings appearing brownish with numerous hyaline spots.....**D. picticornis** Grimshaw
3'. Tibiae not banded; antennae with 3rd segment entirely black.....4
4 . Antennae with upper edge of 2nd segment brownish; wings with 3 fuscous cross-bands and no detached spots in 2nd or 3rd posterior cells .....**D. grimshawi** Oldenberg
4'. Antennae with 2nd segment entirely yellow; wing pattern similar, but more broken up, with isolated fuscous spots in 2nd and 3rd posterior cells.....**D. crucigera** Grimshaw
5 . Wings with anterior and apical costal borders continuously infuscated 6

[3] Sturtevant, A. H., The North American species of Drosophila, Carnegie Institution of Washington, Pub. No. 301, p. 117, 1921.

[4] Perkins, R. C. L., Fauna Hawaiiensis, Introduction, p. clxxxix, 1913.

5′. Wings without continuous fuscous anterior border....8
6 . Wings with a broad Z-shaped fuscous mark on disc, extending along 4th vein, between and including the anterior and posterior cross-veins....**D. z-notata** Bryan
6′. Wings without such Z-shaped mark....7
7 . Wings broadly infuscated at base, along anterior margin, and most of veins; 1st posterior cell with a narrow fuscous line close to 3rd vein; thorax yellow with 3 black stripes, of which the middle one is the broadest....**D. undulata** Grimshaw
7′. Wings not broadly infuscated at base; most of submarginal cell infuscated, basal portion clear; large fuscous blotch in 1st posterior cell, which rests upon 4th vein near posterior cross-vein; U-shaped hyaline spot in 2nd posterior cell....**D. perkinsi** Grimshaw
8 . Wings with 2 large, star-shaped fuscous patches on the disc; thorax brown with 2 cinereous stripes, continuing caudad from the light orbits of the front; scutellum yellow at tip....**D. fuscoamoeba** Bryan
8′. Wings and thorax without such markings....9
9 . Central part of marginal cell infuscated, or a fuscous spot near the middle of the 2nd longitudinal vein, overlapping adjoining cells....10
9′. Central part of marginal cell or middle of 2nd vein not infuscated; wing distinctly infuscated only on apical portion of longtiudinal veins 2-4, over cross-veins, or in costal cell....14
10 . Third longitudinal vein with a fuscous spot opposite the posterior cross-vein....11
10′. Third longitudinal vein without such fuscous spot....12
11 . Marginal cell infuscated for the greater part of its length, narrowly clear just beyond tip of 1st vein, and again beyond a point opposite the fuscous spot on the 3rd vein; thorax yellow-brown with 4 conspicuous black stripes; scutellum dark brown with only lateral corners yellow....**D. conspicua** Grimshaw
11′. Fuscous spot in marginal cell no longer than width of wing, faint in some specimens; thorax with 3 dark stripes; pleurae with large dark spot beneath base of wing; legs entirely yellow....**D. lanaiensis** Grimshaw
11″. Fuscous spot in marginal cell scarcely longer than infuscation on 4th vein at posterior cross-vein; this gives appearance of a nearly continuous fuscous band across wing at posterior cross-vein; another across tip of wing; "thorax yellow-cinereous, unstriped or with 2 obscure brown stripes" (4 paratype specimens have mesonotum and pleurae uniformly reddish-brown, scutellum a little lighter)....**D. hawaiiensis** Grimshaw
12 . Dorsum of thorax ochraceous, with 4 distinct brown lines....13
12′. Dorsum of thorax cinereous or reddish-yellow, with obscure brown markings; scutellum dark on disc; fuscous mark on posterior cross-vein is dumbbell-shaped; anterior cross-vein scarcely infuscated....**D. pilimana** Grimshaw
12″. Mesonotum, pleurae, and scutellum entirely ochraceous, without distinct dark markings; "both cross-veins broadly infuscated" (paratype specimen lacks infuscation on anterior cross-vein)....**D. ochracea** Grimshaw
13 . Scutellum brown on disc; wings with strong fuscous spots: around tip of wing; in apical half of 2nd posterior cell, across posterior cross-vein, extending into 1st and 3rd posterior cells; across anterior cross-vein and adjacent parts of 1st basal, submarginal, marginal, and costal cells; faint fuscous mark along middle of marginal and submarginal cells in ♀, reduced in ♂ to faint narrow line along middle of 2nd vein; length 5.5 mm.; abdomen black with yellow markings....**D. lulumahu** Bryan

13′. Scutellum entirely ochraceous; wings with paler fuscous markings; length 4 mm.; abdomen brown, the anterior margins of segments darker.....**D. punalua** Bryan

14 . Apex of wing, or tips of longitudinal veins 2 to 4, infuscated.....15

14′. Apex of wing clear, or no darker than the rest of the wing.....26

15 . Legs yellow or brownish, with femora dark brown or black; dark species 16

15′. Legs entirely yellow, or uniformly reddish-yellow.....18

16. Thorax and abdomen entirely shining black; apex of wing and posterior cross-vein infuscated.....17

16′. Thorax blackish-brown, with 2 broad darker lines on the dorsum, and yellow stripe on pleurae; abdomen black with posterior edges of segments lighter; infuscated over most of 2nd and tips of 3rd and 4th veins and posterior cross-vein.....**D. humeralis** Grimshaw

17 . Length 6 mm.; front black with reddish cross-band above antennae; orbits and vertical triangle shining black; proboscis yellow; antennae black; legs yellow, fore coxae dull black, and all femora shining black.....**D. nigra** Grimshaw

17′. Length 4 mm.; front without reddish cross-band; orbits dull; proboscis dark; antennae dark reddish-brown; legs brownish, with femora shining black.....**D. nigra** var. **iki** Bryan

18 . Posterior cross-vein forming a small Y where it joins the 4th vein, broadly infuscated from tip of 5th vein to 4th vein.....**D. deltaneuron** Bryan

18′. No Y-shaped fork in posterior cross-vein where it intersects 4th vein 19

19 . Posterior cross-vein distinctly and broadly infuscated, the fuscous spot extending onto 1st posterior cell.....20

19′. Posterior cross-vein faintly or not at all infuscated.....21

20 . Thorax reddish-yellow with an obscure central brown stripe; antennae black; abdomen reddish-yellow with dorsal central line and hind margins of segments blackish; (males, only?) bases of front femora on inner side with brush of short, stiff, black hairs.....**D. anomalipes** Grimshaw

20′. Thorax yellow-brown, with obscure blackish patch in front of scutellum, which is reddish-brown; pleurae with brown markings; abdomen dark with small yellow spots at anterior angles of segments; antennae reddish-yellow. (Similar to *D. pilimana*, but lacks fuscous spot on middle of 2nd vein).....**D. paucipuncta** Grimshaw

20″. Thorax and scutellum entirely yellow-ochraceous; or dorsum with obscure dark lines and scutellum light. (Several undescribed species, too poorly represented in collections to warrant descriptions as yet).....**Drosophila** spp.

21 . Antennae and most of the front light yellow or ochraceous.....22

21′. Antennae and front more or less dark; legs yellow.....23

22 . Thorax dark cinereous, pleurae shining blackish-brown; apical half of rather narrow wing slightly infuscated, last 2 sections of 4th vein nearly equal.....**D. flaviceps** Grimshaw

22′. Thorax ochraceous with 6 obscure dark lines; most of 2nd and apical portions of 3rd and 4th veins, and both cross-veins lightly infuscated; last section of 4th vein 1.9 times penultimate.....**D. sadleria** Bryan

23 . Pleurae light or reddish-yellow; last 2 sections of 4th vein of nearly equal length (4th vein index, about 1).....24

23′. Pleurae dark brown; last section of 4th vein longer than penultimate (4th vein index greater than 1).....25

24 . Anterior and apical portions of wings infuscated; thorax reddish-yellow; abdomen shining brown, yellow at base.....**D. infuscata** Grimshaw

24′. Tips of 2nd, 3rd, and 4th veins and posterior cross-vein infuscated; thorax and abdomen lighter.....**D. kaulu-ai** Bryan

25 . Thorax and scutellum reddish-yellow, pleurae dark brown; apex of 2nd and 3rd veins (and 4th lightly) infuscated, posterior cross-vein not infuscated.....**D. sordidapex** Grimshaw

25′. Thorax and scutellum shining blackish-cinereous, scutellum with yellow tip; front light yellow above antennae, blackish behind; antennae yellow with upper edges of 2nd and 3rd segments dark; posterior cross-vein and apex of wing slightly infuscated.....**D. haleakalae** Grimshaw

26 . Wings with costal cells dark fuscous, and costal margin slightly infuscated; thorax and abdomen entirely shining black; legs yellow, those of ♂ with conspicuous hairs on fore tibiae and metatarsi; 4th vein index 1.5.....**D. setiger** Grimshaw

26′. Wings with costal cell and costal margin clear.....27

27 . Wings with one or both cross-veins clouded with fuscous, entire wing (except in *D. parva*) tinged with yellow or light brown.....28

27′. Wings without any distinct fuscous markings (although they may be uniformly tinged with yellow, pale brown, or gray).....30

28 . Last section of 4th vein twice as long as penultimate (4th vein index equals about 2); 2nd vein curved forward at tip; thorax dark cinereous, with 3 obscure dark lines; abdomen blackish-brown; length about 1.5 mm.....**D. parva** Grimshaw

28′. Last two sections of 4th vein nearly equal (4th vein index equals about 1); front brown with orbits and vertical triangle blackish....29

29 . Thorax and scutellum reddish-yellow to reddish-brown; legs yellow to reddish-yellow; abdomen yellow with dorsal median line and hind halves of segments blackish.....**D. sharpi** Grimshaw

29′. Thorax and abdomen blackish, segments of latter narrowly edged with yellow; legs with fore coxae and all femora blackish-brown, tibiae yellowish .....**D. olaae** Grimshaw

(Wings without fuscous markings)

30 . Intermediate and hind tibiae yellow with dark rings; thorax yellow or orange-yellow, with 5 brown stripes; abdomen dark brown, segments with lighter edges; wings uniformly tinged with light brown or gray 31

30′. Tibiae not ringed with black; dorsum of thorax without such stripes 32

31 . Wing (4 mm.) longer than body (3.5 mm.); pleurae reddish-yellow, blotched with dark brown; fore legs with coxae reddish-yellow, femora shining dark brown, short and very much swollen, with long black hairs on upper and outer surfaces (only ♂ known), tibiae equal in length to femora and yellowish; middle and hind legs with normal femora, shining dark brown, tibiae yellow with 2 dark rings.....**D. crassifemur** Grimshaw

31′. Wings (4 mm.) shorter than body (4.25 mm.); pleurae dark brown, mesopleurae edged with yellow below; legs with fore coxae and all femora shining blackish-brown; tibiae yellowish, the fore pair with indistinct, other two with 2 distinct brown rings.....**D. nasalis** Grimshaw

32 . Femora dark.....33

32′. Femora entirely light yellow.....36

33 . Arista extremely short-haired; small, blackish species: thorax obscurely dark brown or blackish, abdomen blackish, lighter toward the tip, femora shining black; very small (2 mm.) ..... **D. mauiensis** Grimshaw

33′. Arista longer-haired; large species 34

34 . Thorax and abdomen entirely dark brown or blackish; 3rd segment of antennae reddish-yellow ..... **D. molokaiensis** Grimshaw

34′. Thorax, abdomen and parts of the head gray with small reddish-brown spots, one at the base of each bristle or large hair, some fused together into blotches; abdomen with interrupted dark bands on the posterior margins, lateral margins pale; 3rd segment of antennae dark brown 35

35 . Front coxae dark reddish-brown below ..... **D. repleta** Wollaston

35′. Front coxae pale below ..... **D. mulleri** Sturtevant

36 . Last 2 sections of 4th vein equal or nearly equal in length (4th vein index equals about 1) 37

36′. Last section of 4th vein at least half as long again as penultimate (4th vein index equals about 1.5) 41

36″. Last section of 4th vein about 2 (or more) times penultimate (4th vein index equals 2 or more) 44

37 . Thorax shining black or dark brown; wings of ♂ faintly infuscated; antennae and front of ♂ light yellow; front of ♀ varies from shining dark brown to reddish brown ..... **D. melanosoma** Grimshaw

37′. Thorax, at least in part, yellow or brownish-yellow 38

38 . Thorax reddish-yellow, with 3 obscure dark stripes; pleurae reddish-yellow, a patch on mesopleurae and spot beneath wings blackish; antennae large, reddish-brown, with a long, tortuous, many-plumed arista ..... **D. longiseta** Grimshaw

38′. Thorax, including pleaurae, entirely yellow or reddish-yellow, mesonotum not distinctly striped 39

39 . Front dark ferruginous, with orbits and vertical triangle shining; antennae brown, 2nd segment dark brown above, reddish-yellow below; abdomen dark brown, basal angles of segments yellow; wings tinged with yellow ..... **D. cognata** Grimshaw

39′. Front yellow; 2nd segment of antennae entirely yellow; abdomen yellow, hind margins darker 40

40 . Third segment of antennae yellow; mesonotum and scutellum dull brownish-yellow; pleurae and legs pale yellow; lower apical part of front femora with a row of short stout bristles; abdomen dull yellow, each of the 4 basal segments with an interrupted black band; wings may be clouded at tips of 1st and 2nd veins and over posterior cross-vein; length 2.5 mm., wing 2.7 mm. A very common, introduced species ..... **D. immigrans** Sturtevant

40′. Third segment of antennae somewhat brownish; front femora without (?) such row of bristles; mesonotum, pleurae, and scutellum reddish-yellow; abdomen yellow with hind margins of segments brownish; length 3 mm., wing 3.5 mm. ..... **D. xanthosoma** Grimshaw

41 . Thorax with mesonotum light (yellow or reddish-yellow) 42

41′. Mesonotum dark (shining black or blackish-brown), abdomen black, last segment shining 43

42 . Abdomen dark brown with obscure yellow spots at the basal angles of the segments; mesonotum with 3 brown stripes, scutellum dark brown; 2nd vein curved forward near apex; length 2 mm. ..... **D. inaequalis** Grimshaw

42′ Abdomen yellow with hind border of each segment dark brown; mesonotum unstriped, scutellum yellow or reddish-yellow; tip of 2nd vein nearly straight toward apex; length 2.5 to 3 mm. ..... **D. monticola** Grimshaw

43 . Front light yellow with orbits black; antennae entirely reddish-yellow ..... **D. verifrons** Grimshaw

43′. Front reddish-yellow in front, shining black above; antennae reddish-yellow, 3rd segment brown..... **D. polita Grimshaw**

43″. Front black, orbits lighter; antennae dark brown, arista with 3 hairs above and none below..... **D. obscurifrons** Grimshaw

44 . Thorax yellow or reddish-yellow; front and antennae yellow.....45

44′. Thorax darker (olive brown to black); front dark; antennae dark, at least in part.....46

45 . Abdomen yellow, tip black; arista with 3 hairs above and none below; thorax and scutellum entirely yellow; length 1.5 mm. (A variety has the 3rd segment of the antennae brown)..... **D. pusilla** Grimshaw

45′. Abdomen dark on posterior portions of segments; arista with 5 branches above and 3 below; thorax and scutellum shining reddish-yellow; length 2 mm. A very abundant, introduced species..... ..... **D. melanogaster** Meigen

46 . Front black or dark brown.....47

46′. Front reddish-yellow; thorax olive brown; arista of antennae with at least 6 hairs above and 3 below; legs light, femora yellow..... ..... **D. plumosa** Grimshaw

47 . Front dark brown, the orbits cinereous; antennae reddish-brown, the 3rd and upper part of 2nd segments brown; face yellow-cinereous with a very conspicuous keel; thorax obscure brownish-yellow, traces of 3 lighter stripes on the pleurae; abdomen dark brown, lighter toward base; legs yellow..... **D. carinata** Grimshaw

47′. Front black, orbits and vertical triangle shining, a little lighter; antennae, thorax and abdomen uniform blackish-brown; legs pitchy brown. Face dark brown or blackish, without keel. Pleurae a little lighter than mesonotum..... **D. obscuricornis** Grimshaw

47″. Front black, reddish-yellow near base of antennae; face blackish with slight keel; antennae brown, 2nd segment reddish-yellow, arista with 3 hairs above and none below; thorax blackish-brown, pleurae lighter, olive-brown; abdomen blackish, last segment shining; legs yellow..... **D. exigua** Grimshaw

Drosophila lulumahu new species.

General color ochraceous, with brownish markings. Mesonotum with 4 narrow brown stripes, the outer pair on posterior half only; wings with 7 fuscous spots, some of which run together. Like *D. punalua,* but larger and darker.

Front golden brown, orbits and a narrow central line lighter. Ocelli clear yellow, at the corners of a black ocellar triangle. Usual arrangement of strong black bristles on the front and vertex; a few small black hairs above base of antennae and between lower fronto-orbital bristles. Antennae brown, lighter on the sides of the two basal segments; second segment with numerous small black bristles; third segment with dark pile; stout dorso-basal arista, curved midway, with about 15 branches above, more closely spaced toward the base, and 5 on the outer half below, with a few fine, short hairs between; the base of the arista enlarged. Face light yellow-brown, like the orbits; one pair of stout vibrissae, followed by a row of small black bristles on the sides of the oral cavity. Proboscis dark brown, like the antennae; palpi broad, thin, medium brown, with black pubescence; cheeks light, occiput dark in the center, light on the sides.

Mesothorax cinereous-brown, with dark brown markings as follows: 2 narrow median lines, extending from its anterior edge to just before the

scutellum; a narrow brown line on each side of these behind the transverse suture; on the disc of the scutellum; an interrupted spot across humerus to presutural bristle; a line forward from base of wing; and a spot directly below base of wing on the pteropleura. With higher magnification the following dark brown spots may also be seen: at the lower end of the propleura; at the juncture of sternum, hypopleura, and pteropleura; and enclosing the posterior spiracle. A normal Drosophila arrangement of thoracic bristles, fairly strong and black; the 2 pairs of dorsocentral bristles set well back, close together, just before the scutellum; scutellum with light colored sides, one pair of lateral and one pair of crossing, apical bristles. Halteres light yellow. Males have the pleurae darker than the females, with a prominent pair of bristles on the sides of the sternum.

Legs of the female light brown throughout; those of the male darker, with dark brown femora. In both sexes there is a row of 5 or 6 strong bristles above and 4 below, on the outer face of the front femora, and a comb of strong bristles on the antero-lateral aspect of the middle coxae. The male, in addition, has a number of long, fine hairs on the front tibia, especially a prominent group of 4 near its juncture with the femora.

Abdomen with the anterior portion of each segment light, the posterior half dark, in the female; more extensively dark in the male, only part of the basal segment yellow in some specimens.

Wings yellowish, with veins light and dark brown, and fuscous spots as follows: a small spot in the outer third of the costal cell, extending across the adjacent portions of the marginal, submarginal, and 1st basal cells, to the anterior cross-vein; spots at the tips of the 2nd, 3rd, and 4th longitudinal veins, which may run together; and a spot enclosing each end of the posterior cross-vein, which run together along that cross-vein, forming a dumbbell-shaped mark. The females in addition have a large spot across the middle of the marginal and submarginal cells, which is reduced in the males to a slight cloudiness on the middle of the 2nd longitudinal vein. Costal index 4 to 5; 4th vein index, 1.2 to 1.3; 4 C index, .45 to .55; 5 X index, .75 to 1.0.

Length: 5.5 mm.; wing, 6 mm.

Described from a series of 9 males and 8 females, all collected by F. X. Williams at Lulumahu Valley, Oahu, 1936 to 1937. Holotype male and allotype female, collected April 25, 1937, in a banana grove, No. 820 in B. P. Bishop Museum; paratypes in collection of H.S.P.A.

D. lulumahu and *D. punalua* are related to *D. pilimana* Grimshaw, specimens of which were collected by Dr. R. C. L. Perkins in the Waianae Mountains, Oahu. Although the description of *D. pilimana* is not definite and there is but a single female paratype specimen in local collections, the writer believes that the absence of definite stripes on the mesonotum and the smaller and more restricted fuscous spots on the wings, definitely distinguish *D. pilimana* from *D. punalua* and the present new species.

Drosophila deltaneuron new species.

General color of head and thorax brown, abdomen shining dark brown; mesonotum without distinct markings; tips of 2nd, 3rd, and 4th veins, and both cross-veins distinctly infuscated; other parts of the wing smoky, especially the costal and marginal cells; the posterior cross-vein forming a distinct Y where it intersects the 4th vein.

Front smoky brown, ocellar triangle darker, with crystal-white, bead-like ocelli. Face lighter (smoky-ochraceous), the keel and ocellar margins almost white. Margin of the oral cavity at the vibrissal angle black, with a row of black bristles, alternating short and long, gradually decreasing in length toward the lower angles, at which are placed two long and several short black bristles. Hind margin of eyes with a continuous row of black bristles, and an incomplete 2nd row. Vertical and ocellar bristles large. Antennae brown, almost unicolorous with the front, the 2nd segment with two long and several short bristles; arista located near the upper angle of the 3rd segment, with 7 rays above and 3 beneath, those beneath paired with the apical 3 above.

Mesonotum brown, almost the same shade as front and antennae. Two pairs of dorsocentral bristles, in front of which are a pair of hairs, only slightly larger than the surrounding acrostical hairs, of which there are 8 rows between the dorsocentrals. Arrangement of macrochaetae normal. A dark brown spot below the wings, and a dark stripe running forward from wing base. Scutellum only slightly darker brown than mesonotum, with 1 pair of lateral and 1 pair of apical bristles, all strong.

Legs uniformly brown, concolorous with the thorax. Front femur with a ventral row of 5 graduated bristles and 2 lateral preapical bristles; middle tibiae with strong apical and preapical bristles. All three coxae with combs of curved bristles. Claws black and distinct.

Wings with a normal venation, except for the Y-shaped fork in the posterior cross-vein where it meets the 4th longitudinal vein. Infuscated as described above. The entire surface of the wing in some specimens smoky. Costal vein edged with short bristles, a pair of larger ones at the tip of the 2nd break (before the tip of the 1st vein), and one bristle near the middle of the 1st section of the costa, near the base of the wing. A row of fine black bristles along the margin of the alula. The wing vein indexes are as follows:

Index	Males	Females	Average
Costal index	5.2 (4.6 -5.7)	5.0 (4.4 -6.3)	5.1
4th vein index	1.38(1.27-1.48)	1.42(1.26-1.5)	1.4
4 C index	.48(.41- .52)	.54(.44- .48)	.51
5 X index	.73(.64- .79)	.72(.60- .82)	.72

Abdomen uniformly dark brown, shining, the surface with numerous small black bristles.

Length: 4 mm.; wing, 4 mm.

Described from a series of 5 males and 7 females, collected by F. X. Williams at Lulumahu Valley, Oahu: types (♂ and ♀) May 2, 1937, No. 818 in B. P. Bishop Museum, paratypes, September 27, 1936, to May 2, 1937, in collection of H.S.P.A. The specimens were collected in and near a banana grove.

This species differs from all other species of Drosophila hitherto described from Hawaii in the small, but distinct, triangular cell formed by a fork of the posterior cross-vein where it intersects the 4th vein.

Drosophila sadleria new species.

Ochraceous, the thorax with 6 pale brown lines on the dorsum; wings with both cross-veins and the tips of 2 to 4 and 5 faintly infuscated.

Front, face, antennae, proboscis and palpi ochraceous, the upper orbits on the front and the vertical triangle darker, a pale orange band across the

base of the antennae. Ocellar bristles strong, proclinate and parallel; vertical bristles strong. The type has a 4th fronto-orbital bristle on the left side, laterad to and on almost the same level as the lower; usual 3 fronto-orbital bristles on the right side. The second antennal segment is large and bears 2 or 3 medium size and several shorter bristles; arista pale brown, with 6 branches above and 2 below. Oral margin on each side, beneath the eye, with a row of small bristles, one or more of the middle ones strong; continued around the hind margins in a row of bristles as strong or stronger.

Thorax ochraceous, dorsum with 6 pale brown longitudinal stripes, the lateral one on each side extending forward only to the transverse suture; pleurae with 3 parallel horizontal, darker stripes, the middle one running forward from the base of the wing. Normal chaetotaxy, bristles strong, the 2 pairs of dorsocentrals set well back, before the scutellum. Scutellum unicolorous, with strong lateral and subapical pairs of bristles, the latter crossing.

Abdomen dark brown, the posterior edges of segments narrowly lighter, each segment with a row of small bristles along its lighter edge. Terminal segment with fine golden-brown hairs.

Legs ochraceous; coxae with strong bristles; front femora with 2 rows of moderately strong bristles, 4 each, curving outwardly; middle tibiae with 2 nearly apical bristles; front tarsi with double row of long, dark reddish-brown hairs.

Wings with both cross-veins, and the apical portions of veins 2 to 4 and last section of vein 5 (continuing from the posterior cross-vein) faintly infuscated. The central portion of the wing is faintly tinged with fuscous, especially along the 2nd vein. Costal index (left) 4.1, (right) 4.3; 4th vein index (left) 1.95, (right) 1.90; 4 C index (left) .78, (right) .74; 5 X index (both) 1.06.

Length: 3 mm.; wing, 4 mm.

Type, ♀, Niu, Oahu, December 11, 1910 (O. H. Swezey), ex rachis of Sadleria fern. Described from a single female, Type No. 819 in B. P. Bishop Museum.

Other pupa cases of Drosophila flies have been found by Mr. Swezey in Sadleria fern stems, at Kilauea, Hawaii, May, 1920. These are 4 to 5 mm. long, shining reddish-brown, impressed at the anterior end.

A New Species of Gall Midge Predacious on Mealybugs

BY DR. E. P. FELT
Stamford, Conn.

(Presented by Dr. Carter at the meeting of February 4, 1937.)

Dicrodiplosis guatemalensis n. sp.

The gall midges were received under date of December 11, 1935 from Dr. Walter Carter, accompanied by a statement that they were reared from brilliant carmine colored larvae, predacious on mealybugs, the specimens being labelled "Guatemala May 1935". The species is tentatively referred to this genus.

Male.—Length 1.5 mm., antennae nearly as long as the body, rather thickly haired, mostly dark brown, the distal portion of the segments yellowish, fourteen segments, the fifth with stems one-half and one and one-half times their diameter, the basal enlargement globose, the distal enlargement with a length twice its diameter, slightly constricted in the middle; there are whorls of stout setae nearly as long as the segment, basally on the basal enlargement, distally on the distal enlargement, the circumfila moderately numerous and with a length about equal to the diameter of the enlargement; palpi quadriarticulate, the first segment quadrate, the second with a length one-half greater than its width, the third and fourth each with a length about four times the width; eyes fused at the apex; mesonotum, scutellum and post scutellum reddish-brown, abdomen mostly yellowish-brown; wings hyaline; halteres whitish, transparent; legs thickly haired, mostly dark brown, femora and tibiae narrowly banded with yellowish at the apex, tarsal segments broadly banded apically with yellowish, the distal tarsal segment of the posterior legs yellowish-white; claws long, strongly curved, unidentate, the pulvili rudimentary; genitalia yellowish; basal clasp segment moderately long, broad, with a small basal process, terminal clasp segment slender, as long as the basal clasp segment; dorsal plate triangularly emarginate, the lobes tapering and narrowly rounded; ventral plate long, divided, the lobes long, slender, and broadly rounded; harpes broadly sickle-shaped; style long, slender.

Female.—Length 1.5 mm., antennae about one-half the length of the body, rather thickly haired, mostly dark brown, the tips of the segments obscurely yellowish, the fifth with a stem one-fourth the length of the cylindrical basal enlargement, which latter has a length about five times its diameter; ovipositor short, the lobes long, broadly rounded, with a length about five times their width and rather thickly setose. Other characters about as in the male.

Types deposited in the U. S. National Museum, co-types in the collection of the Experiment Station, Pineapple Producers Cooperative Association, Ltd., Honolulu, Hawaii.

Orchid Insects

BY D. T. FULLAWAY
Board of Agriculture and Forestry

(Presented at the meeting of November 4, 1937)

In view of the present great interest in orchid cultivation in Hawaii, an account of the insects and other invertebrates which attack the orchid plant, or are commonly encountered in cultivating these plants, may be found useful by orchid growers. Many of these insects are common greenhouse pests and can be dealt with readily by one means or another well known to growers; others are attached to the orchid plant and have to be constantly guarded against, or eliminated if they gain entrance to one's collection of plants, in order to maintain the collection in good condition, for insect species which are specific in their relationship to host-plant are generally serious pests.

Orchids, or plants of the family Orchidaceae, comprise one of the largest groups of flowering plants; the range of their distribution is world-wide. The plants that are grown here as choice ornamentals are all imported plants and have come from many different and widely separated regions; for example, the Orient, the Antipodes, North and South America, and Europe (from collections). It is not unusual in the circumstances that the pest list for orchids is rather full. If all the species encountered in the examination of orchid importations had succeeded in establishing themselves in Hawaii, our pest list would indeed be a lengthy one, but it is believed that most of them have been intercepted and have not got a foothold here. Some, however, have had to be contended with for years, because the nature of their attack is such that difficulty is experienced in discovering them in imported plants; or treatment of plants, when they are discovered, is inadequate to effect their elimination. I refer particularly to the weevils, scale insects, etc. Another consideration, exigent at the moment, is the rapid rate of expansion of collections in recent years. This will undoubtedly result at length in the appearance of many new orchid pests here, for pest accession generally runs proportionate to volume of imports. It is beginning to be evident already.

Detailed discussion of pests will follow in the order of their importance.

GREENHOUSE PESTS

These include scales and mealybugs, thrips, red spider, aphis (*Cerataphis lataniæ* is the only species here, but another species, *Macrosiphum luteum,* has been intercepted many times on Central

and South American orchids at mainland stations), whitefly (none attacking orchids here, but *Aleurodicus guppyii* intercepted as above). Mealybugs commonly found on orchids here are mostly the common greenhouse mealybug, *Pseudococcus longispinus. P. lilacinus* is very commonly found on orchids from the Philippine Islands, but as far as is known, it is not established here. *P. maritimus,* which it is believed is established here, has been found on orchids imported from the mainland, but it is not generally found on orchids here.

There is a long list of scales found on orchids. Considering the soft (unarmored) scales (Coccinae) first, the commonest one is *Coccus pseudohesperidum,* which appears to be attached to the orchid plant. Many collections in Hawaii are infested with this scale, which is quite prolific, and very injurious to the plants. Other soft scales reported on orchids are *Saissetia hemisphærica, Coccus hesperidum* and *Coccus capparidis,* but I consider these infestations as more or less incidental. Then there are two odd scales, *Asterolecanium aureum* and *Vinsonia stellifera,* which are commonly found on orchids imported from Central and South America, the former apparently attached to the orchid plant. Hard (armored) scales (Diaspinae) found on orchids include species that are apparently attached to the orchid plant and those that are more or less incidental in their lodgment. In the former category I would place *Diaspis boisduvali,* Furcaspis biformis, Parlatoria pseudaspidiotus, P. proteus, Hemichionaspis townsendi, Leucaspis cockerelli, Conchaspis angræci, Phenacaspis dendrobii.* The first four and the sixth in this list (i.e. *L. cockerelli*) are believed to be established in Hawaii. In the latter category I place the following: *Pinnaspis aspidistræ, P. buxi, Aspidiotus palmae, A. spinosus, Chrysomphalus rossi, Pseudoparlatoria parlatorioides, P. ostreata, Pseudischnaspis bowreyi, Lepidosaphes tuberculata.* Of these only the two species of *Pinnaspis* and *C. rossi* are well-established species in Hawaii.

Many species of thrips have been found on orchids also, but as far as I know only one is attached to the orchid plant, namely, *Anaphothrips orchidii.* Two others found on orchids in Hawaii are *Hercothrips femoralis* and *Taeniothrips xanthius.* The following have been intercepted: *Hoplandrothrips nigricestus, Parthenothrips dracaenae, Heliothrips errans, Aplothrips melaleuca, Frankliniella sp., Amblythrips sp., Neophysopus sp.* and *Liothrips sp.*

Treatment recommended for these insects is nicotine sulphate solution: strength 1-400/600.

Mites or red spiders are often troublesome in greenhouses. The species concerned are not well known but most of the interceptions on orchids are referred to either *Tenuipalpus* or *Stigmaeodes.* Mite infestations respond quickly to treatment. Sulphur dust is indicated, but must be used with caution.

* This species is often associated with a disease (soft rot) which ruins many plants.

Ants are often a nuisance in greenhouses, but with proper equipment and attention can be easily controlled. Slugs and snails and isopods (sowbugs) also. Cockroaches often do damage to root-tips, buds and flowers. They are usually controlled by placing out poisoned bait—phosphorus paste or arsenic on slices of bread. Spiders, centipedes, millipedes, collembola, psocids and other verminous forms are often encountered in the peat about the roots of orchid plants, but one can readily dispose of them so they are not of much consequence, except when they use the orchid plant as a hide-out and are transported with the plant into new territory.

There are many instances on record of other insects being carried from one region to another in this manner, e.g. termite communities, ant communities, orthopterous egg-masses, embiids, heteropterous bugs, and so forth.

WEEVILS

There are a number of rhyncophorous forms which are specifically attached to the orchid plant. Recently five of these, pertaining to the Oriental region, were shown to be closely related forms, and were all referred to the newly-erected genus *Orchidophilus*. One of these species, *O. aterrimus,* has been coming into Hawaii in orchid plants from the Philippines and other oriental regions, particularly on orchids of the genus *Phalaenopsis,* for thirty or forty years, and may be considered established here, although its status is doubtful, since it is impossible in most cases to determine whether the few individuals collected are from recently imported or older plants. They are usually taken as adults, and one giving close attention to the care of his plants can generally rid the collection of this pest in time. The larva or weevil is a borer, generally found working near the stem base, where injured and discolored tissue or die-back indicates its presence. The weevil should be removed, when discovered, by excision, the wound being sterilized with a fungicidal application, alcohol or sulphur dust, to prevent further necrosis. Bait traps may be set for the adult insects. Orchid growers claim this beetle may be easily trapped by maintaining a few orchids with exposed roots (Oncidiums, for example) in the infested orchid house. The beetles are attracted to the tender tissue at the root tips and can be captured there and destroyed.

The South American species, *Diorymerellus laevimargo,* has not been known here so long, but since 1934 has attained nearly the same status as *Orchidophilus aterrimus,* and as many of the shipping firms on the mainland now have this weevil firmly established in their houses, it is expected it will be increasingly difficult to prevent its establishment here. The species seems to some extent to be partial to Dendrobiums, and is often referred to by growers as the dendrob weevil, although it has been observed to attack several other kinds of orchids. As compared with *Orchidophilus aterrimus,* the adult beetle is much smaller (less than 2 mm. long), smooth and

shining black instead of rough and dull black, the elytra each with six pitted longitudinal lines or grooves instead of eight as in *aterrimus*. Its damage to the plant is generally confined to new and tender growth of stem and leaf or buds and flowers and is quite characteristic. The larva is hatched from an egg inserted in the stem base, and bores in the stem or larger roots, considerably weakening the plant. This insect was studied in greenhouses in New Jersey by Hamilton, who found the best control measures to be hand-picking. Use of paradichlorobenzine was also recommended; treatment of individual pots for 24 hours with 4 gm. paradichlorobenzine scattered uniformly over the peat of a four-inch pot resulted in 95-100% mortality, even 2 gm. often gave a satisfactory "kill".

Another orchid pest in this group of insects is the ambrosia beetle, *Xylosandrus morigerus,* which has been intercepted many times in *Dendrobium* shipments from Australia. As far as I know it is not established here. The larvae or weevils are stemborers and their excavations greatly weaken the plant. The adult beetle is a typical shot-hole borer, about 1 mm. long, brown or black and shining, without an extended snout such as the previously mentioned species have, and with short, compact, hairy body, short, clubbed antennae. The species is believed to be attached to the orchid plant and might be a serious pest if it became acclimatized here.

Other rhyncophorous beetles intercepted on orchids occasionally are *Tadius erirhinoides, Cholus cattleyae* and *Baris* sp.

MOTH BORER AND CATERPILLARS

Not much is known about lepidopterous pests of orchids, as none occur in Hawaii to my knowledge. In South America the giant Castnias often attack bulbous plants and in the Philippine Islands there is said to be a tortricid which attacks flower stems and damages blooms considerably.

BUGS

There are many heteropterous bugs reported as orchid pests, mostly mirids. One species, *Mertila malayensis,* is commonly found on orchids imported from the Orient; another, *Tenthecoris bicolor,* is common on South American orchids. The latter species was once intercepted here on a plant from Brazil, with developmental stages present, proving beyond doubt that the species is attached to the orchid plant and was not incidental to that particular shipment. As usual with bug infestations, the population was composed largely of nymphs, and as the infestation was heavy, the plant was badly damaged.

MIDGES, FLIES

The only dipterous insect found on orchids to my knowledge is the midge *Parallelodiplosis cattleya,* which has been taken a number

of times on imported Cattleyas. Apparently the pest is of South American origin. The larvae are usually found in the roots and are quite destructive to the root tissue. As far as I know the pest has not become established here.

The bloom of certain orchids becomes an attrahent of the melon fly (*Chaetodacus cucurbitae*), probably on account of the scent thrown off, as males of these flies seem to be drawn by odors. No damage to the plant results from the visits of the flies, as far as I have been able to learn.

THE SO-CALLED "CATTLEYA FLY"

There is still another common insect pest of Cattleyas which has been brought into Hawaii many times but as far as I know is not established here—that is the so-called "cattleya fly." This insect, however, is not dipterous; it is a small black eurytomid wasp (*Isosoma orchidearum*), which is attached to the orchid plant, and is believed to emanate from South America. The larvae are phytophagous in habit and very harmful to plants which they infest. They attain a length of 6 mm., feed in the bulb, stems, leaves and buds of many kinds of orchids besides Cattleyas and can only be got rid of by the complete destruction of the infested portions of the plants, or possibly by vacuum fumigation.

New Species from the Bishop Museum Collection of Samoan Parasitic Hymenoptera

BY D. T. FULLAWAY
Board of Agriculture and Forestry

(Presented at the meeting of November 4, 1937)

ICHNEUMONINAE

Ichneumon samoanus n. sp.

Female.—12 mm. long, wing expanse 20 mm. Head (including antennae) and thorax (including legs) reddish brown to black or blackish, abdomen reddish brown, pedicellate 1st segment slightly infuscate, 2nd and 3rd tergites marked with black—a median longitudinal line on 2nd extending apically from base more than half the length, a median spot basally on 3rd; wings infumate.

Head transverse, only half as thick as wide, length from vertex to apex of clypeus equals or slightly exceeds width, coarsely punctate or rugose except on occiput which is smooth and shining with minute pin punctures, hairy clothing sparse and fine except on clypeus, labrum and parts of face; eyes large and bulging slightly, hardly emarginate, ocelli arranged in an obtuse triangle, lateral members a little further from eye than distance between same, vertex and face comparatively flat, front excavate, a slight median elevation or tubercle on anterior margin, separation of face and clypeus indistinct but clypeal fossae rather deep, anterior margin of clypeus barely curved, genae and occiput quite wide, latter sloping outwardly, mandibles stout, fairly wide at base and acute apically, bidentate, upper tooth twice as long as lower, maxillary palpi

5-segmented and slender, labial palpi 4-segmented, short and fairly stout. Antennae much shorter than body and fairly thick, 37-segmented, 1st segment stout, 2nd and 3rd equal in length which is about three times diameter, following segments progressively shorter except the last which is about twice penultimate. Abdomen a little longer than thorax, which is stout and coarsely reticulately sculptured or coarse punctate, prothoracic furrow wide and shallow, striate, mesonotum punctate without parapsidal grooves, mesopleura striate, a line of costae along posterior margin, a deep, smooth sulcus separating mesonotum and scutellum, which is keystone-shaped, subconvex, longitudinally striate and joined to mesonotum with sharply edged carinae; metanotum short, transverse, with a median, striated elevation and deep lateral grooves, the pleura with a carinate posterior margin connected with the propodeum by a pair of carinae which are continuous with its ends; propodeum somewhat globose, areolated in pattern shown in drawing, spiracle elongate

oval, posterior margin extended in a prominent projection between base of coxae and base of pedicel. Abdomen depressed to apex of 3rd segment, 4th and following segments more cylindrical tapering to a point, 1st tergite longer than width at apex with median strap-like longitudinal elevation, flat in front of angle and striate, 2nd tergite a little shorter than width at apex with a groove or depression in basal lateral area and short striae extending outwardly from basal margin, 3rd tergite nearly twice as wide as long with a small basolateral depression, tergites 4 to 7 progressively shorter and narrower; ensheathed ovipositor extended very little beyond tip of last segment. Legs fairly stout and covered with cinereous to silvery hairs most heavily outwardly, claws without teeth. Wings with lanceolate stigma and veins black, areolet complete, pentagonal, nervulus inclined to be postfurcal, subdiscoidal entering the discoidal below the middle, nervellus in hind wing broken by auxiliary vein one-fifth its length from lower end. In some specimens the abdomen is apically fuscous. Antennae in male with outer segments somewhat globose.

Described from four specimens (2 ♀ ♀ and 2 ♂ ♂, type, allotype and paratypes) collected at Safune and Salailua, Savaii, Samoan Islands, May 1st and 2nd, 1924, by E. H. Bryan, Jr.

PIMPLINAE

Echthromorpha samoana n. sp.*

Female.—10 mm. in length, wing expanse 22 mm., ovipositor 3.5 mm. long; antennae 33-segmented, nearly as long as the body, 4th segment not as

* While this issue of the "Proceedings" was in the press, our attention was called to R. A. Cushman's description of the above species in Proc. R. Ent. Soc. Lond. (B) 7, pt. 2 (Feb. 1938) p. 40. On account of earlier publication the species must be ascribed to Cushman, not Fullaway, and the typical material listed herein designated "co-types" instead of "type, allotype and paratype." [Editor].

long as the 5th and 6th together, remaining segments successively shorter to the penultimate, which is a little longer than broad, last segment twice as long as broad with flattened, rounded end. Head smooth, polished, face, clypeus, labrum and genae however displaying some very fine punctuation; pronotal sulcus striate, mesonotum, mesopleura (except disc and callosity), mesosternae and propodeum (except median apical and lateral basal areas) shallowly rugoso-punctate, thorax otherwise smooth and shining; a deep sulcus (bounded laterally by sharp ridges—extensions of the carinate mesonotal margination) between the mesonotum and scutellum, which is more finely and sparsely punctate and shining, postscutellum polished on disc, with deep lateral sulci, vestiture of fine silky hairs on all sculptured areas. Abdominal tergites for the most part smooth and shining with sparse, coarse, shallow punctuation on segments 2-6, that on 7 much finer, punctuation on 8th tergite deeper and closer, hairy vestiture inconspicuous except on last three segments, an apical band on segments 1-5, narrow medially but widening laterally, a shallow groove marking the anterior limit of the band on segments 2-5, which is continued inwardly to anterior margin of segment, 7th tergite with conspicuous median longitudinal groove, ovipositor with sheath finely, transversely sculptured and hairy; legs variously surfaced, smooth, reticulately sculptured or punctate and clothed for the most part with a fine pile, coxae, trochanters and femora with long hairs.

Reddish brown in color with yellow markings as follows: on face (including clypeus and labrum) and extending around antennal grooves and ocelli to narrow orbital band which connects with the genae, on mesopleura in front on disc and callosity, a spot in lower posterior angle, disc of scutellum and postscutellum; on propodeum two areas at or near apical margin on either side of middle, apical band of 1st to 4th tergites, all the coxae and fore and midtrochanters, on mesonotum, tegulae and a faint longitudinal band on either side of the median black stripe, ovipositor and ocellar area black, antennae concolorous with body that is reddish brown with fine, short hairs in a linear arrangement; wings hyaline with suffusion of yellowish brown. Male a little smaller and slenderer, reddish brown but often without all the vivid yellow markings seen in the female.

Described from 13 females and 34 males collected in the Samoan Islands as follows: Type, Reservoir Fagatoga Trail, Tutuila, Am. Samoa, D. T. Fullaway, collector; allotype, same locality, collected in March 1930; paratypes: 3 females Aua-Afono Trail, Tutuila, collected by D. T. Fullaway, March 1930, 4 females, Fagasa Trail, Tutuila, same collector, Feb.-March, 1930, 1 female, Amouli, Tutuila, same collector, Feb. 1930, 1 female Pago Pago, Tutuila, collected by Swezey and Wilder, Sept. 29, 1923, 1 female Salailua, Savaii, collected by E. H. Bryan, Jr., May 19, 1924, 2 females Safune, Savaii, same collector, May 3, 1924, taken on *Raillardia* at 2000 ft., 8 males Aua-Afono Trail, Tutuila, Am. Samoa, collected by Fullaway in March of 1930, 3 males Fagasa Trail, same collector and date, 1 male Reservoir Trail, Fagatoga, Tutuila, same collector and date, 1 male Fagaitua Trail, Feb. 1930, 1 male Leone-Alaua Trail, March 1930, Fullaway collector, 1 male Tutuila, April 1918, Kellars collector, 1 male Fagasa, Tutuila, Sept. 9, 1923, Swezey and Wilder collectors, 2 males Afono Trail, Sept. 25, 1923, 1 male Pago Pago, Sept. 19, 1923, same collectors, 1 male Malololelei, Upolu, 7/8/25, 1 male same 4/26/24 on *Raillardia*

2-4000 ft. former collected by G. P. Wilder, the latter by E. H. Bryan, Jr., 4 males Safune, Savaii, collected by E. H. Bryan, Jr., May 23, 1924, in the rain forest and lower forest areas, 5 males Salailua, Savaii, same date and collector, in the rain forest area. Type, paratypes and allotype in collection of the B. P. Bishop Museum.

Eugalta samoana n. sp.

Female.—10 mm. in length, wing expanse 21 mm., ovipositor 4.5 mm. long, antennae 36-segmented, as long as the body, with elevated bases separated by deep groove, scape and pedicel stout, flagellum filamentous, 1st segment at least six times as long as wide, following segments progressively shorter, penultimate segment twice as long as wide, last segment less. Head smooth, polished, face, clypeus and genae showing some fine punctuations where there is a hairy clothing, eyes large, bulging, bare, occupying the whole sides of the head, somewhat emarginate within, opposite base of the antennae, ocelli prominent, elevated, members separated by half their diameter, lateral members almost touching eye, front excavate, face flat, a little longer than wide, not separated from the clypeus except by clypeal pits and groove, anterior margin slightly rounded, genae very narrow, widening four times to join the flat occiput, which is declivous behind eyes, mandibles apparently bidentate, the upper tooth larger and longer than lower, maxillary palpi four-segmented, labial palpi three-segmented. Thorax smooth and shining throughout, prosternites advanced in front of pronotum and forming with it an extension or neck which joins the head in occipital cavity, pronotal sulcus broad, not carinate, mesonotum convex, without parapsidal furrows but with faintly indicated lobes, mesopleura slightly convex with deep grooves at front and hind margins, scutellum convex, separated from the mesonotum by a deep sulcus with carinate lateral margins, propodeum globose, separated from the metapleura by a longitudinal sulcus running alongside the round spiracle—a carina also runs the length of this sulcus to outer apical angle, then turns inward a short distance, then backward about as far. Abdomen depressed to apex of fifth segment, sixth and seventh segments more cylindrical and compressed, 1st segment three times as long as apically wide, 2nd, 3rd, and 4th longer than wide but less than twice as long, 5th quadrate, 6th, 7th and 8th much wider than long, the tergites extending on to the sides considerably, tergites 2, 3 and 4 with deep lateral impressions extending inwardly forewards and backwards from about middle of segment, tergites 3-8 with hairy clothing, which is thicker on apical tergites, all the abdominal spiracles well forward of the middle of the segments. Legs fairly long and stout, hind legs longer than fore or middle legs, coxae stout, tibiae longer than femora, tarsi about same length, all clothed with hairs, last tarsal segment much longer than penultimate, claws lobate beneath but without tooth. Wings with narrow lanceolate stigma, second recurrent nervure joining cubitus beyond cubital cross-vein, without an areolet, 1st recurrent nervure broken below middle, nervellus in hind wing unbroken, no auxiliary vein.

Head, pro- and mesothorax and apical abdominal segments yellowish brown or amber, metathorax, middle and hind legs to tibiae and basal abdominal segments mahogany brown, legs outwardly reddish brown, wings infumate, stigma and veins dark brown.

Described from one female (type) collected on Savaii, Samoan Islands, at Safune (rain forest 2000 ft.), May 3rd, 1924, by E. H. Bryan, Jr.

Two Genera of Hawaiian Drosophilidae (Diptera).

BY JOHN R. MALLOCH

U. S. Biological Survey, Washington, D. C.

(Presented by E. H. Bryan, Jr., at the meeting of November 4, 1937)

This paper contains the descriptions of a new genus and species, and the description of an already known genus originally described from the Seychelles Islands, recently found in Honolulu.

Tantalia n. gen.

Generic description—This genus belongs to that group in which there are four series of intradorsocentral hairs on the mesonotum, but differs from any of them in having the anterior pair of dorsocentrals as strong as the posterior pair and situated at or very close to the suture, the scutellum convex, narrowed behind and a little longer than its basal width, with the basal pair of bristles close to the base, longer than the dorsocentrals and about 1.5 times as long as the apical pair which latter are at the tip and rather closely placed; the presutural bristle is also longer and stronger than usual; the prescutellar pair of acrostichals are undeveloped; and in the two dark spots on the costal margin of the wing between the apices of the first and second veins there are cross veins connecting the latter with the costal vein, while in the dark spot at the apex of the second vein there is a short spur vein on the hind side of the vein.

Genotype, the following new species.

Tantalia albovittata, n. sp.

Male and Female.—General color rather dull testaceous yellow, the face in the female, frons in both sexes and a broad central vitta on the mesonotum that extends to the apex of the scutellum densely white dusted; in the male the face is blackened below and the central vitta on the mesonotum does not obscure the yellow ground color on the anterior half. Antennae whitish-yellow in female, darker in male; palpi in female, palpi and prelabrum in male black. Mesonotum with a dark brown or blackish vitta on each side of the white central vitta that extend over lateral edges of the scutellum; a blackish-brown mark on upper edge of the mesopleura and another on center of pleura. Legs yellow. Wings grayish hyaline, with a slight brown cloud over the furcation of second and third veins, three dark brown spots equally spaced on costa from above inner cross-vein to apex of second vein, similarly colored clouds over the cross-veins, a spot on middle of ultimate section of fourth vein, and a small mark on apices of third and fourth veins. Abdomen yellow, with a black or brown fascia on apex of each tergite that is usually broken in center.

Head seen from in front distinctly wider than high, face narrower than either eye, facial carina narrowly rounded. Frons subquadrate, slightly narrowed in front, the orbits moderately differentiated; all four vertical bristles, the upper reclinate orbital pair, and the ocellar pair long and strong; postvertical pair weaker, about equal in length to the proclinate pair of orbitals, the lower reclinate pair close to base of latter, short and hair-like. Eyes stiff-haired, reniform. Antennae short, arista with 4 strong rays, none distinctly below. Gena almost linear, vibrissae strong.

Mesonotum with four series of intradorsocentral hairs that do not extend behind the posterior pair of dorsocentrals; sternopleurals 2.

Legs normal, all tibiae with preapical dorsal bristle, the mid tibia with an apical ventral spur; fore tarsi of the male shorter and stouter than the others, with irregular erect stiff black hairs above, mid tarsi not so noticeably haired, hind pair normal.

Hypopygium of male with a pair of yellow, boot-shaped, downwardly directed processes and a pair of much smaller blackish spines.

Costa with a pair of fine bristles at apex of first section and with regularly spaced outstanding hairs above and below on the edge of the costal vein in addition to the usual short setulose hairs. Inner cross-vein at middle of the discal cell, outer cross-vein at about 2.5 times its own length from inner and about 1.5 times its length from apex of fifth vein; anal vein and cell distinct.

Length, 1.5 mm.

Type, Waiahole, Oahu, Mar. 28, 1915 (O. H. Swezey); allotype, Olympus, Oahu, 2,000 feet, Oct. 25, 1936 (F. X. Williams); paratypes, Tantalus, Oahu, Mar. 24, 1907 (R. C. L. Perkins). Types in Bishop Museum.

Dettopsomyia Lamb.

Trans. Linn. Soc. London, vol. 16, pt. 4, p. 349 (1914).

This genus was originally described from the Seychelles Islands and the occurrence of the genotype in the Hawaiian islands is particularly noteworthy. Lamb's specimens were damaged and a redescription of his species is given to supplement his description and insure identification of the species.

There are three other species of the genus known from the Netherlands East Indies.

Dettopsomyia formosa Lamb.

Male.—Head black, frons dull, with a narrow stripe along orbit and one on each side of the ocelli, the two latter curving inward in front of ocelli and forming a single line to anterior margin where they connect with a yellowish spot between the antennae; genae largely testaceous-yellow; face silvery dusted, most noticeably so on the upper raised half. Antennae, palpi, and prelabrum black; aristae yellow on basal half, black beyond. Thorax black, shiny, mesonotum with two grey dusted vittae that are interrupted along center round the bases of the dorsocentral bristles and setulae, and a gray dusted vitta on each side of these behind the suture; humeri grey dusted; pleura with two grey dusted vittae, one on upper edge and the other on center; scutellum grey dusted on each basal lateral angle and at extreme tip. Legs black, with the following whitish-yellow annuli: at apices of all femora, at bases, near middle, and at apices of all tibiae; tarsi yellow. Wings blackened, most deeply so at subcostal lobe and along the costa, with the following hyaline spots: in subcostal cell, 2 in marginal cell beyond apex of the first vein, the first one comma-like, one in anterior basal cell, 3 in first posterior cell, one near apex of the discal cell, 5 small ones in second posterior cell, and two or three along the posterior side of the fifth vein. Halteres yellow. Abdomen glossy black.

Frons about two-thirds of the head width, quadrate, the ocelli almost midway between vertex and anterior margin; all verticals strong, the inner pair proximad of the outer and almost in line with them; postverticals of

moderate length; ocellars long, proclinate; all orbitals crowded together close to anterior extremity of the orbits, the upper reclinate one strong, the lower one minute, the proclinate one about half as long as the upper reclinate. Antennae rather large, third segment tapered to apex, emarginate above; arista with about 6 rays above and 3 below. Face with a snout-like carina on upper half; gena about one-third as high as eye; vibrissae moderate. Eye a little longer than high, stiff-haired.

Thorax with bristles and hairs almost as in the preceding species, but the scutellum is shorter, more broadly rounded in outline, and the apical pair of bristles are a little longer than the basal pair and all four are more equally spaced on the margin.

Legs without exceptional features.

Wings with a very distinct notch at apex of the first section where it is rather definitely lobed and has a pair of fine bristles; second vein running almost parallel to third, gradually diverging from costa, subangularly bent forward near tip and entering costa at a right angle a little before midway between apex of first and third veins, the marginal cell at its tip about three times as wide as the submarginal at same point; third and fourth veins undulated on apical sections, divergent at tips; inner cross-vein not over one-third from apex of the discal cell, outer one farther from apex of fifth than from inner cross-vein.

Abdomen broadly ovate, flattened.

Length, 1.5 mm.

Honolulu, on window, Jan. 15, 1936 (F. X. Williams).

This species may be a very recent introduction, and its spread will be of interest.

A New Empidid Fly in Hawaii

BY DR. A. L. MELANDER

College of City of New York

***Chersodromia hawaiiensis** Melander, sp. nov.

Length 1 to 2 mm. Head black, bristles black; front and face about equally broad; eye facets coarse and uniform; antennae brownish, the third joint darkest, style piceous; proboscis testaceous, one-half the head-height, palpi yellowish. Thorax piceous black, cinereous pollinose, the bristles and setulae black, pleura including sternopleura silvery pollinose, four dorsocentrals, acrostichals in four rows, four or six scutellar bristles. Abdomen brownish, the venter yellowish, hairs short, fine and pale, pygidium slightly darker, not enlarging the end of the abdomen. Coxae and base of femora pale yellow, remainder of legs brownish, hind coxae tipped beneath with a transverse pecten of black setulae, more noticeable in male; middle tibiae with a single extensor seta at one-third the length; hind tibiae with eight setae, of which one is located near three-fifths the length of the flexor side, the others irregularly placed along the extensor faces. Wings full size, subhyaline, with weak infumation; marginal hairs distinct, the costal ones blackish, those of hind margin pale, costal basal bristle strong and black; veins piceous but yellowish at root; apical costal sections proportioned about 2:2:1, third vein usually recurved toward tip, sometimes parallel with the fourth vein, crossveins touching; alulae and their hairs pale yellowish; halteres pale yellow.

Six males and eight females taken by Dr. F. X. Williams, May 29 to June 1, 1936, about the excavation holes of crabs on the beach of Hanauma Bay, Oahu. One male and one female paratype are placed in the Bishop Museum and one male and one female paratype in the collection of the Hawaiian Entomological Society, the remainder being retained for the present in the author's collection.

This species differs from the European *Chersodromia Beckeri* Melander, to which it keys in the Genera Insectorum, fascicle 185, page 296, in having the hairs and bristles of head and thorax black, the sternopleura pollinose, and the veins darkened.

* This is the fly reported by Dr. Williams in Proc. Haw. Ent. Soc., IX, No. 3, p. 364, 1937. [Ed.]

Another New Cerambycid in Hawaii

BY DR. R. C. L. PERKINS
Newton Abbot, England

(Presented by F. X. Williams at the meeting of April 1, 1937)

Neoclytarlus chenopodii n. sp.

This species appears to be allied to *Neoclytarlus immundus* (Sharp), which was placed by Sharp in *Plagithmysus*. Like that species it is conspicuously dimorphic in color, the male being a red, the female a black insect. Also the legs are unlike those of typical members of the genus, *N. fragilis* and its allies, the hind femora thickening gradually from comparatively near the base, so that the club is very long. The male is well clothed over almost the whole of the upper surface with yellowish pubescence, so that the dense white stripes along the suture of the elytra (such as form the characteristic pattern of so many species of *Plagithmysus*) being of the same color, do not stand out conspicuously from the general clothing. In the female on the other hand they are extremely conspicuous, as the general surface of the elytra is nearly bare. At their basal extremity they become divergent near the middle of the length of the elytra.

Pronotum with the median crest broad and hardly raised, with a transverse raised line in front and two posteriorly; between the one in front and the others there are some less definite elevations. In the male this part is well clothed, though the median crest is barer; in the female there is usually a distinct yellow vitta on either side of the crest and sometimes a second one exterior to this on each side and these may be connected with the inner ones both in front and behind. In some specimens the vittae are absent or very little developed, a very remarkable form of variation if not due to abrasion. The metepisterna in one female is sparsely clothed with yellow pubescence, which apically forms a dense yellow spot; in others this is less evident or the metepisterna may be bare, except for minute, inconspicuous hairs. The sculpture of the elytra is dense, the punctures on the basal part distinct, but behind this they become indefinite, with a finer and more regular sculpture. The abdomen beneath in the male is densely pubescent all over, but in the female almost bare. The hind femora in the latter are dark, black or pitchy, sometimes throughout or with the basal fourth or third more or less reddish.

Length of large specimens 12 mm., of the smallest 5.5 mm.

I have examined 8 males and 4 females of this interesting species, all of which were bred specimens. *N. immundus* above mentioned was bred from dead wood of the tree *Charpentiera obovata*.

Hab. Oahu, Waianae Mts., Palikea, 1500 feet. The specimens emerged from dead stems of *Chenopodium oahuensis*, collected by Dr. F. X. Williams, in November 1936. Numerous specimens issued Dec. 26th, 1936 to Jan. 10th, 1937.

Types are to be deposited in the collection of the Hawaiian Entomological Society, Honolulu.

Cyclohexylamine, an Attractant for *Lathyrophthalmus arvorum* (Fabr.)

BY DONALD STARR AND KAM HU LAU
U.S. Bureau of Entomology and Plant Quarantine

(Presented by O. C. McBride at the meeting of December 3, 1937)

During the testing of fifteen nitrogen compounds as Mediterranean fruit fly attractants it was observed that in every case the lures containing cyclohexylamine were attractive to *Lathyrophthalmus arvorum* (F.).*

The compound was found to be repellent to the Mediterranean fruit fly (*Ceratitis capitata* Wied.).

The lure which contained 9.4 g. of casein, 5.0 g. of sodium hydroxide, 12.9 g. of air slaked lime, and 3.7 g. of cyclohexylamine per liter was compared at a distance of 18 inches with a check lure containing the same ingredients except for the cyclohexylamine. The amine was dried over solid potassium hydroxide and distilled at 133° to 134° C. Glass traps were used in citrus trees about 6 feet from the ground, located at the Hawaii Agricultural Experiment Station. Counts were made after 2 days' exposure. The comparisons were made using four pairs of traps four different times.

The total catch was 557 *L. arvorum* or an average of 35 flies per trap with a mean deviation of 46 percent. There was a total catch of four flies in the control traps while only an occasional specimen was found in the other nitrogenous lures.

The repellency of cyclohexylamine for *Ceratitis capitata* was shown by a catch of 440 flies in the check traps with none in the amine traps.

The 15 nitrogen compounds included cyclohexyl-, methyl-, ethanol-, hydroxol-, and phenyl- amines, ammonia, hydrazine, ethylene diamine, putrescine, pyridine, piperidine, urea, acetamide, and hydrofuramide.

* The identification was checked by Mr. E. H. Bryan.

Host Plant Records of the Species of Proterhinus (Col.) in Hawaii

BY O. H. SWEZEY
Experiment Station, H.S.P.A.

(Presented at the meeting of December 3, 1937)

There are 136 species and several varieties of the beetles of the Genus *Proterhinus* recorded in the Fauna Hawaiiensis. A few of them were described previously by Dr. Sharp (24) and Mr. Blackburn (6), but the original descriptions of by far the majority of them are by Dr. Perkins in Fauna Hawaiiensis, II, pp. 185-246, 1900; and III, pp. 656-666, 1910. Later descriptions by Dr. Perkins in various issues of the Proceedings of the Hawaiian Entomological Society total 21 species, bringing the grand total up to 157. Two species have been described from Nihoa, an outlying island of the Hawaiian group. Besides these, one species has been described from the Phoenix islands; one from Samoa; three from the Marquesas islands. These latter and the species from the Phoenix islands form a connecting link with the genus *Aglycyderes,* and, hence, Dr. Perkins considers that the family name Proterhinidae should be abandoned and our *Proterhinus* be placed in the family Aglycyderidae, an older family name.

In the Fauna Hawaiiensis, there are not many records of the host relations of the species of *Proterhinus.* No doubt Dr. Perkins was aware of more of the host relations than what were recorded. Since the collecting period of Dr. Perkins, not much collecting of *Proterhinus* was done for a time. Mr. Giffard collected very thoroughly the species occurring on Mt. Tantalus, Oahu, about 1904-1910, at the time when he maintained a mountain house on Mt. Tantalus. His material was not worked up, however, not being labelled with the host trees from which they were collected. When submitted to Dr. Perkins for determination, he declined on account of the lack of data as to host trees.

It was not till about 15 years ago that the writer began giving particular attention to collecting *Proterhinus* of whatever regions he was collecting in, and keeping careful records of host trees. During these recent years considerable additional data has been obtained, and it seems appropriate that this should be recorded.

Herewith are listed those species which have any record of their host trees or plants, together with hitherto unpublished records. The original descriptions are cited, localities where collected, and collectors given. For convenience of reference, the species are listed alphabetically. As will be seen, there is yet much research necessary to complete the knowledge of the host plants of this group of beetles.

Perhaps some of the records given may not indicate the true hosts as only a few specimens were collected on the trees mentioned, and they may have been stragglers. When a series of specimens has been actually reared from any particular tree, or collected from it exclusively, or in large numbers and on different occasions and places, then there is assurance of true host relations. It is apparent that some of the species are attached to a single kind of tree, yet there are quite a number which breed in several kinds of trees.

For the most part the larvae of the various species of *Proterhinus* live in dead twigs; some are in bark; a few are leafminers; at least one has been found in living stems.

The list includes 82 species and 13 varieties.

Proterhinus abnormis Perkins

Perkins, Proc. Haw. Ent. Soc., IV, p. 352, 1920.

OAHU: Mt. Kaala, Sept., 1913, and July, 1916, 11 examples, leafminer in *Broussaisia arguta* (Swezey); Mt. Kaala, 1919, 1925, 1938, same plant (Swezey, Williams); Puu Kalena, 1929, same plant (Swezey).

Proterhinus abundans Perkins

Perkins, Bishop Museum, Bull. 31, p. 65, 1926.

NIHOA: On *Euphorbia,* 1923 (Bryan).

Proterhinus adelus Perkins

Perkins, Fauna Hawaiiensis, II, p. 202, 1900; F.H., III, p. 657, 1910.

OAHU: Throughout Koolau range (Perkins). (Specimens at Bishop Museum labelled *Kadua*); Kaumuahona, Feb. 25, 1928, on *Gouldia* (Swezey); Moanalua Valley, 1930, on *Coprosma,* Poamoha, 1933, on *Bobea,* Pauoa Flats, 1934, on *Gouldia,* Mt. Olympus, 1936, on *Cheirodendron,* Kaluanui, 1938, on *Gouldia* (Swezey).

Proterhinus adelus var. **chrysadelus** Perkins

Perkins, Fauna Hawaiiensis, III, p. 658, 1910.

OAHU: Kaumuahona, 1928, on *Scaevola* (Swezey).

Proterhinus alyxiae Perkins

Perkins, Fauna Hawaiiensis, II, p. 244, pl. IX, fig. 23, 1900.

MOLOKAI: 3000 ft.; LANAI. Taken from stems of *Alyxia olivaeformis* (Perkins).

Proterhinus amaurodes Perkins

Perkins, Fauna Hawaiiensis, II, p. 190, 1900.

KAUAI: Mts., 2000-4000 ft. (Perkins); Kokee, Aug., 1925, one specimen on *Straussia mariniana* (Swezey).

Proterhinus angularis Sharp

Sharp, Trans. Ent. Soc. London, 1881, p. 530.

Perkins, Fauna Hawaiiensis, II, p. 243, 1900; III, p. 659, 1910.

OAHU: Mts. near Honolulu on *Straussia* (Perkins); Palolo, 1920, on *Straussia* (Bryan); Manoa, 1923, on *Straussia* (Swezey); many localities on *Straussia* (Swezey).

Proterhinus angustiformis Perkins
Perkins, Fauna Hawaiiensis, II, p. 197, 1900.
KAUAI: Halemanu (Perkins); Kokee, Aug., 1925, 26 specimens from *Coprosma waimeae* and 23 from *Alyxia olivaeformis* (Swezey).

Proterhinus angustiformis var.
KAUAI: Kokee, Aug., 1925, one specimen each on *Gouldia elongata* and *Suttonia sandwicensis* (Swezey).

Proterhinus anthracias Perkins
Perkins, Fauna Hawaiiensis, II, p. 185, 1900.
KAUAI: Widely distributed, 2500-4000 ft. (Perkins); Kokee, Aug. 1921, and Aug. 1925, numerous under bark of *Straussia mariniana* (Swezey).

Proterhinus antiquus Perkins
Perkins, Fauna Hawaiiensis, II, p. 193, 1900.
KAUAI: Mts., 4000 ft., on various trees (Perkins); Kokee, Aug., 1925, one specimen on *Coprosma waimeae* (Swezey).
OAHU: Mt. Kaala, one example on *Broussaisia arguta* (Swezey).

Proterhinus archaeus Perkins
Perkins, Fauna Hawaiiensis, II, p. 209, 1900; F.H., III, p. 666, 1910.
OAHU: In both Mtn. ranges, under bark of *Straussia*, also on *Pelea* and other trees (Perkins); Kahana, 1928, Waikane, 1930, Haleauau, 1931, Waipio Ridge, 1932, Hauula, 1933, all on *Straussia* (Swezey).

Proterhinus asteliae Perkins
Perkins, Proc. Haw. Ent. Soc., IV, p. 351, 1920.
OAHU: Mt. Kaala, July, 1916, 14 examples on *Astelia veratroides* (Swezey); Mt. Kaala, 1923, 1925, on *Astelia* (Swezey).

Proterhinus basalis Sharp
Sharp, Trans. Ent. Soc. London, 1879, p. 98.
Perkins, Fauna Hawaiiensis, II, p. 187, 1900.
KAUAI: Mts., 2000-4000 ft. (Perkins); Kokee, Aug., 1921, 25 specimens from *Scaevola chamissoniana*, and 7 more in Aug., 1925, single specimens on *Coprosma waimeae* and *Suttonia sandwicensis*, Aug., 1925 (Swezey).

Proterhinus binotatus Perkins
Perkins, Fauna Hawaiiensis, II, p. 191, 1900.
KAUAI: Mts., 4000 ft. (Perkins); Kokee, Aug., 1925, 28 specimens from dead twigs of "ohia ha" (*Syzygium sandwicense*) (Swezey).

Proterhinus blackburni Sharp
Sharp, Trans. Ent. Soc. London, 1878, p. 17.
Perkins, Fauna Hawaiiensis, II, p. 246, pl. X, fig. 5, 1900; F.H., III, p. 666, 1910.
On all the Islands. On ferns and many kinds of forest trees (Perkins); OAHU: Mt. Tantalus, bred from *Pipturus*

(Giffard); Mt. Olympus, 1920, on ohia ha (Swezey); Manoa, 1920, on ohia ha (Bridwell); Nuuanu, 1919, on *Euphorbia,* Pauoa, 1922, in bamboo, Mt. Tantalus, 1926, on *Pelea,* 1930, on *Perrottetia,* Arboretum trail, Manoa, 1926, on *Bobea,* Waimano, 1926, in dead stem of *Cibotium* frond, Kaumuahona, 1928, *Cibotium,* Pauoa Flats, 1935, ex *Wikstroemia* (Swezey); Mt. Kaala, 1929, Haleauau, 1929, 1930, Palolo, 1935, in *Cibotium chamissoi,* Kukuiala, 1936, on *Gouldia* (Swezey).

MOLOKAI: Puu Kolekole, 1929, in *Cibotium chamissoi* (Swezey).

Proterhinus blackburni var. **hystrix** Sharp

Sharp, Trans. Ent. Soc. London, 1881, p. 527.
Perkins, Fauna Hawaiiensis, II, p. 246, 1900.

MOLOKAI: Kawela and Waikolu, 1925, in dead frond stems of *Cibotium menziesii* (Swezey and Bryan).

MAUI: Mahena, 1926, in *Cibotium menziesii* (Swezey).

HAWAII: On *Cibotium* (Swezey).

Proterhinus blackburni var. **bisignatus** Perkins

Perkins, Fauna Hawaiiensis, II, p. 246, 1900.

OAHU: Mt. Kaala, 1928, 1929, in bark of *Metrosideros* (Swezey, Williams); Mt. Tantalus, 1935, in bark of *Metrosideros tremuloides* (Swezey).

Proterhinus bridwelli Perkins

Perkins, Proc. Haw. Ent. Soc., IV, p. 350, 1920.

MAUI: Iao Valley, Sept., 1918, a single male on *Euphorbia hookeri integrifolia* (Bridwell).

Proterhinus bryani Perkins

Perkins, Bishop Museum, Bull. 14, p. 64, 1926.

NIHOA: On *Euphorbia,* 1923 (Bryan).

Proterhinus calliphyas Perkins

Perkins, Fauna Hawaiiensis, II, p. 224, 1900.

MAUI: Haleakala, 4000-5000 ft. Attached to *Alyxia olivaeformis* (Perkins).

Proterhinus convexiusculus Perkins

Perkins, Fauna Hawaiiensis, II, p. 232, 1900.

MOLOKAI: Kamiloloa, 1925, on *Coprosma* (Swezey and Bryan).

Proterhinus coprosmicola Perkins

Perkins, Proc. Haw. Ent. Soc., VII, p. 195, 1928.

OAHU: Pacific Heights, 1600 ft., on *Coprosma* (Bridwell).

Proterhinus cristatus Perkins

Perkins, Proc. Haw. Ent. Soc., VII, p. 510, 1931.

OAHU: Mt. Kaala, Feb. 9, 1930, from dead twig of *Broussaisia arguta* (Swezey); Haleauau, 1935 in *Broussaisia,* Mt. Kaala, 1938, in *Bidens* (Swezey).

Proterhinus deceptor Perkins

Perkins, Fauna Hawaiiensis, II, p. 245, 1900; F.H., III, p. 664, 1910.

OAHU: Widely distributed. On hau, *Gossypium tomentosum* and other trees (Perkins); Diamond Head, one on *Lipochaeta* (Timberlake); Ewa Coral Plain, one on *Euphorbia* (Bridwell); Palehua, on koa, Makua, 1925, on kukui, Kawaihapai, 1926, on kukui, Hauula, 1933, on *Scaevola* (Swezey); Kamokunui Valley, 1933, on kukui, Makapuu, 1934, on *Gossypium,* Mt. Olympus, 1935, on ohia ha (Swezey).

KAUAI: Kokee, Aug., 1925, a few specimens on *Myoporum sandwicense* and *Pipturus albidus,* a doubtful specimen on *Antidesma platyphyllum* (Swezey).

LANAI: On kukui and ohia lehua (Giffard).

MAUI: Waikapu Valley, 1924, on pamakani, Iao Valley, 1924, on *Bobea,* pamakani and *Pipturus,* Waihee Valley, 1926, on *Cyrtandra* (Swezey).

MOLOKAI: Puu Kolekole, 1929, on *Dubautia* (Swezey).

Proterhinus deceptor var. **major** Perkins

Perkins, Fauna Hawaiiensis, II, p. 246, 1900.

HAWAII: Kilauea, 1917, on *Hibiscadelphus giffardianus* (Swezey); Nauhi, 1931, on *Metrosideros polymorpha* (Swezey and Williams); Kilauea, 1925, on koa (Williams).

Proterhinus deceptor var. **clermontiae** Perkins

Perkins, Proc. Haw. Ent. Soc., VII, p. 198, 1928.

OAHU: Pauoa, July, 1917, on *Clermontia* (Bridwell).

Proterhinus deinops Perkins

Perkins, Fauna Hawaiiensis, II, p. 201, 1900; F.H., III, p. 657, 1910.

OAHU: Waianae Mts., 3000 ft. (Perkins); Mt. Kaala, 6 specimens, Feb., 1928, 7 specimens, Feb., 1930, 4 specimens, Jan., 1931, 5 specimens, Jan., 1932, 1 specimen, July, 1933, all in dead twigs of *Broussaisia arguta* (Swezey); Haleauau, 1935, same plant (Swezey).

Proterhinus denudatus Perkins

Perkins, Fauna Hawaiiensis, II, p. 203, 1900; F.H., III, p. 661, 1910.

OAHU: Both Mtn. ranges. In stems of staghorn fern (Perkins); Kamokunui Valley, 1933, swept from ferns (Swezey).

Proterhinus difficilis Perkins

Perkins, Fauna Hawaiiensis, II, p. 188, 1900.

KAUAI: Mountains (Perkins); Kokee, Aug., 1925, one specimen on *Antidesma platyphyllum* (Swezey).

Proterhinus dispar Sharp

Sharp, Trans. Ent. Soc. London, 1881, p. 528.
Trans. Dublin Soc., III, pl. V, fig. 41, 1885.
Perkins, Fauna Hawaiiensis, II, p. 243, 1900.

OAHU, MOLOKAI, LANAI: Attached to *Wikstroemia* (Perkins).

OAHU: Malamalama, 1925, Pacific Hts., 1926, Kahauiki, 1926, Lanihuli, 1928, Pauoa Flats, 1934, 1935, on *Wikstroemia foetida* (Swezey).

Proterhinus dubiosus Perkins
Perkins, Fauna Hawaiiensis, II, p. 187, 1900.
KAUAI: Halemanu, 4000 ft., Makaweli, 2000 ft. (Perkins); Kokee, Aug., 1921, 5 specimens on *Acacia koa*, Aug., 1925, 10 specimens on *Acacia koa* and a few on *Antidesma platyphyllum, Bidens cosmoides, Suttonia sandwicensis* and *Cryptocarya mannii* (Swezey).

Proterhinus echidna Perkins
Perkins, Fauna Hawaiiensis, III, p. 658, 1910.
OAHU: Mts. near Honolulu. On *Gouldia* (Perkins); Mt. Tantalus, 1933, one on *Metrosideros* (Swezey).

Proterhinus epichrysus Perkins
Perkins, Fauna Hawaiiensis, II, p. 218, 1900.
MAUI: Haleakala, 5000 ft. (Perkins); Kula pipe line, Olinda, 1926, in stems of *Rubus*, March, 1930, 5 specimens from *Cheirodendron gaudichaudii* (Swezey).

Proterhinus epimelas Perkins
Perkins, Fauna Hawaiiensis, II, p. 226, 1900.
MAUI: Olinda, 1927, one specimen on *Pelea* (Swezey).

Proterhinus epitretus Perkins
Perkins, Fauna Hawaiiensis, II, p. 229, pl. X, fig. 2, 1900.
LANAI: 2000-3000 ft. Attached to the stems of the fronds of the tree-ferns (Perkins).
MOLOKAI: Puu Kolekole, in *Cibotium chamissoi* (Swezey).
MAUI: Kula pipe line trail, 1926, 1935, in *Cibotium menziesii* (Swezey).

Proterhinus eugonias Perkins
Perkins, Fauna Hawaiiensis, II, p. 186, 1900.
KAUAI: Mts., 4000 ft. (Perkins); Kokee, Aug., 1925, several specimens on *Bobea mannii*, 4 from *Elaeocarpus bifidus*, 2 from *Osmanthus sandwicensis*, 2 from *Pipturus albidus*, 1 each from *Sideroxylon sandwicense, Cryptocarya mannii, Cyrtandra* sp. (Swezey).

Proterhinus eulepis Perkins
Perkins, Fauna Hawaiiensis, II, p. 188, 1900.
KAUAI: Mts., 4000 ft. (Perkins); Kokee, Aug., 1925, a few specimens on *Alyxia olivaeformis, Bidens cosmoides, Lobelia yuccoides* (Swezey).

Proterhinus euops Perkins
Perkins, Proc. Haw. Ent. Soc., IV, p. 348, 1920.
OAHU: Mt. Kaala, July, 1916, 12 examples on *Euphorbia* (Swezey).

Proterhinus euphorbiae Perkins
Perkins, Proc. Haw. Ent. Soc., IV, p. 349, 1920.
OAHU: Mt. Kaala, July, 1916, 3 females on *Euphorbia;* June, 1919, 2 females on *Euphorbia* (Swezey); Lanihuli, 1918, on *Euphorbia* (Swezey); Kukuiala Valley, 1933, on *Euphorbia* (Swezey).

Proterhinus excrucians Perkins
Perkins, Fauna Hawaiiensis, III, p. 662, 1910.
OAHU: Ewa Coral Plain, on Sida (Bridwell); many localities 1923 to 1935, on *Suttonia, Metrosideros, Bobea,* ohia ha, *Gouldia* (Swezey).

Proterhinus ferrugineus Perkins
Perkins, Fauna Hawaiiensis, II, p. 241, 1900.
HAWAII: 4000 ft. In the leaf-stems of tree-ferns (Perkins); Nauhi Gulch, 5000 ft, 1931, in *Cibotium* (Swezey and Williams); Kohala, 1925, in *Sadleria* (Williams).

Proterhinus fuscicolor Perkins
Perkins, Proc. Haw. Ent. Soc., IV, p. 353, 1920.
MAUI: Haleakala near Puu Nianiau, Aug., 1918, 26 examples on *Argyroxiphium virescens* (Swezey); same locality and plant, 1927 (Swezey).

Proterhinus gigas Perkins
Perkins, Fauna Hawaiiensis, II, p. 185, 1900.
KAUAI: 4000 ft. Under bark of *Cheirodendron* (Perkins); Kokee, Aug., 1925, 14 specimens from *Tetraplasandra waimeae, Lobelia yuccoides* (Swezey); Kumuwela, 1928, on *Lobelia yuccoides* (Swezey).

Proterhinus impressiscutis Perkins
Perkins, Proc. Haw. Ent. Soc., IV, p. 350, 1920.
OAHU: Mt. Kaala, July, 1916, a single female on *Euphorbia* (Swezey); Mt. Kaala, 1923, on *Euphorbia* (Swezey).

Proterhinus impressiscutis var. **nudior** Perkins
Perkins, Proc. Haw. Ent. Soc., VII, p. 196, 1928.
OAHU: Lanihuli, 1918, 1928, Kuliouou, 1918, 1924, Kahauiki, 1933, Hauula, 1934, on *Euphorbia* (Swezey).

Proterhinus innotabilis Perkins
Perkins, Fauna Hawaiiensis, II, p. 242, 1900.
MAUI: Haleakala, 4000-5000 ft.; MOLOKAI (Perkins).
LANAI: On kukui and ohia lehua (Giffard).

Proterhinus kahanae Perkins
Perkins, Proc. Haw. Ent. Soc., VII, p. 509, 1931.
OAHU: Kahana, Feb. 22, 1928, from dead twig of *Broussaisia arguta* (Swezey).

Proterhinus kamptarthrus Perkins
Perkins, Fauna Hawaiiensis, II, p. 199, 1900.
OAHU: Mt. Kaala, 1929, on *Coprosma,* Haleauau Valley, 1930, on *Coprosma* (Swezey).

Proterhinus laticollis Blackburn
Blackburn, Tr. Dublin Soc., III, p. 170, 1885.
Perkins, Fauna Hawaiiensis, II, p. 211, pl. IX, figs. 15, 15a; F.H., I, p. cxxv, 1913.
OAHU: Waianae Mts. On *Acacia koa* (Perkins).

Proterhinus longulus Sharp
Sharp, Trans. Ent. Soc. London, 1879, p. 97.
Perkins, Fauna Hawaiiensis, II, p. 208, 1900.

OAHU: Both ranges, in stems of ferns (Blackburn) (Perkins); many localities, in *Cibotium chamissoi* and *C. menziesii* (Swezey); Puu Kalena, 1932, in *Phegopteris polycarpa* (Swezey).

Proterhinus maculifer Perkins

Perkins, Fauna Hawaiiensis, II, p. 198, 1900.

KAUAI: Common generally (Perkins); Kokee, 15 examples, Aug., 1921, and 2 examples, Aug., 1925, from dead twigs of *Straussia mariniana* (Swezey), a few on *Gouldia elongata* and *Scaevola chamissoniana* (Swezey).

Proterhinus maurus Perkins

Perkins, Fauna Hawaiiensis, III, p. 658, 1910.

OAHU: Koolau range, 1800 ft., on *Pelea* (Perkins); Mt. Olympus, 1911, 1912, 1918, on *Suttonia lessertiana* var. (Swezey); Palolo, 1917, on *Suttonia* (Bridwell); Wailupe, 1915, Kaumuahona, 1909 (Swezey).

Proterhinus miricornis Perkins

Perkins, Proc. Haw. Ent. Soc., VI, p. 487, 1927.

KAUAI: Kokee, 1925, one specimen on *Bidens cosmoides* (Swezey); Kumuwela and Nualolo, 1932, 19 specimens on same plant (Swezey).

Proterhinus moribundus Perkins

Perkins, Proc. Haw. Ent. Soc., III, p. 251, 1916.

MOLOKAI: On the red-flowered native cotton tree (Perkins).

Proterhinus myrsineoides Perkins

Perkins, Fauna Hawaiiensis, III, p. 659, 1910.

OAHU: Haleauau Valley, 1930, 1932, on *Suttonia,* Puu Kaua, 1932, on *Suttonia,* Mt. Tantalus, 1934, on *Hibiscus* (Swezey).

Proterhinus myrsineus Perkins

Perkins, Fauna Hawaiiensis, III, p. 659, 1910.

OAHU: Mts. near Honolulu, 1500 ft. On *(Myrsine) Suttonia* (Perkins); Olympus, 1918, on *Suttonia,* Waimano, 1926, on *Suttonia,* Kanehoa, 1927, on *Suttonia,* Kawaihapai, 1928, on *Pelea,* Haleauau, 1930, on *Suttonia,* 1932, on *Sideroxylon* (Swezey).

Proterhinus nigricans Sharp

Sharp, Trans. Ent. Soc. London, 1879, p. 95.
Perkins, Fauna Hawaiiensis, II, p. 191, 1900.

KAUAI: Waialeale, 3000 ft. (Blackburn); Makaweli, 2000-3000 ft., Waimea 4000 ft. (Perkins); Kokee, Aug., 1921, four specimens on *Pipturus albidus,* and a few more in Aug., 1925 (Swezey).

Proterhinus oahuensis Perkins

Perkins, Fauna Hawaiiensis, II, p. 208, pl. X, fig. 4, 1900.

OAHU: Mts. near Honolulu, in hard tree trunks (Perkins).

Proterhinus obscuricolor Perkins
Perkins, Fauna Hawaiiensis, II, p. 202, 1900; F.H., III, p. 660, 1910.
OAHU: Mts. near Honolulu, attached to *Straussia* (Perkins); Woodlawn trail, 1927, on *Pelea* (Swezey).

Proterhinus obscurus Sharp
Sharp, Trans. Ent. Soc. London, 1878, p. 18.
Perkins, Fauna Hawaiiensis, II, p. 210, 1900; F.H., III, p. 663, 1910.
OAHU: Widely distributed. On various trees (Perkins); Mt. Olympus, one on *Pritchardia,* Mt. Tantalus on *Bobea* (Swezey); Mt. Kaala, 1929, on *Smilax,* 1931, one on *Broussaisia,* Haleauau, 1932, on *Urera;* Pacific Hts., 1932, on *Bobea* (Swezey).

Proterhinus obscurus var. **perobscurus** Perkins
Perkins, Fauna Hawaiiensis, III, p. 663, 1910.
OAHU: Mountains round Honolulu, abundant on *Perrottetia sandwicensis* (Perkins); Mt. Tantalus, 1925, 1929, 1933, on same tree (Swezey); Kahana, 1928, on same tree, Pupukea, 1933, on *Scaevola* and *Gouldia,* Hauula, 1933, on *Scaevola* (Swezey).

Proterhinus obscurus var. **elaeocarpi** Perkins
Perkins, Fauna Hawaiiensis, III, p. 663, 1910.
OAHU: On *Elaeocarpus bifidus* (Perkins); Haleauau, 1928, 1932, Kaumuahona, 1928, Mt. Tantalus, 1933, Kukuiala, 1933, on same tree (Swezey).

Proterhinus obscurus var. **chryseis** Perkins
Perkins, Fauna Hawaiiensis, III, p. 663, 1910.
OAHU: Kaumuahona, 1917, on *Euphorbia clusiaefolia* (Bridwell); Lanihuli, 1919, Mt. Kaala, 1923, Kuliouou, 1924, Woodlawn trail, 1927, Kahana, 1931, Kahauiki, 1933, Mt. Tantalus, 1934, Halawa, 1935, on *Euphorbia* (Swezey).

Proterhinus oscillans Sharp
Sharp, Trans. Ent. Soc. London, 1878, p. 18.
Perkins, Fauna Hawaiiensis, II, p. 210, 1900; F.H., III, p. 664, 1910; F.H., I, p. cxxv, 1913.
OAHU: Generally distributed. On *Acacia koa* (Perkins); Mt. Tantalus, 1909, 1934, 1935, Palehua, 1922, 1934, Kahauiki, 1926, 1933, Lanihuli, 1928, Waipio Rdg., 1929, Haleauau, 1930, Puu Kaua, 1932, all on *Acacia koa* (Swezey).

Proterhinus pachycnemis Perkins
Perkins, Fauna Hawaiiensis, II, p. 211, pl. IX, fig. 14, 1900.
OAHU: Kukuiala Valley, 1933, one on *Maba* and one on *Hibiscus* (Swezey).

Proterhinus persimilis Perkins
Perkins, Fauna Hawaiiensis, II, p. 224, pl. X, fig. 7, 1900.
MAUI: Iao Valley. Attached to *Wikstroemia* (Perkins).

Proterhinus phyllobius Perkins
Perkins, Proc. Haw. Ent. Soc., IV, p. 352, 1920.
OAHU: Mts. near Honolulu (Perkins); Mt. Olympus, Feb., 1912, leafminer in *Broussaisia arguta* (Swezey); Kaumua-

hona, July, 1916 (Bridwell); many places from Lanipo to Kahana, Hauula and Kawailoa, 1919 to 1938, same plant (Swezey).

Proterhinus pipturi Perkins

Perkins, Fauna Hawaiiensis, III, p. 665, 1910.

OAHU: Mts. near Honolulu, attached to *Pipturus albidus* (Perkins); Mt. Tantalus, 1925, Nuuanu Pali, 1925, Kahana, 1928, Haleauau, 1928, 1932, Kaluanui, 1938, all on *Pipturus* (Swezey).

Proterhinus podagricus var. **coprosmae** Perkins

Perkins, Proc. Haw. Ent. Soc., VII, p. 194, 1928.

OAHU: Mt. Kaala, 1920, a single specimen on *Coprosma* (Swezey).

Proterhinus platygonioides Perkins

Perkins, Fauna Hawaiiensis, III, p. 661, 1910.

OAHU: Kanehoa, 1927, on *Suttonia,* Mt. Kaala, 1930, on *Perrottetia,* Haleauau, 1932, on *Pipturus,* Hauula, 1934, on *Gouldia* (Swezey).

Proterhinus pteridis Perkins

Perkins, Fauna Hawaiiensis, II, p. 235, pl. IX, fig. 24, 1900.

MOLOKAI: 3000 ft. In the leaf-stalk of a species of *Pteris* (Perkins).

Proterhinus punctipennis Sharp

Sharp, Trans. Ent. Soc. London, 1881, p. 530.

Perkins, Fauna Hawaiiensis, II, p. 225, 1900.

MAUI: Haleakala, 4000-5000 ft. (Perkins); Kula pipe line, Olinda, 1926, 11 specimens on *Acacia koa* (Swezey).

Proterhinus pusillus Sharp

Sharp, Tr. Ent. Soc. London, p. 97, 1879.

Perkins, Fauna Hawaiiensis, II, p. 212, 1900.

OAHU: Mt. Tantalus, 1925, Manoa, on *Pelea,* Halona, 1933, on *Osmanthus* (Swezey).

Proterhinus pusillus var. **subpusillus** Perkins

Perkins, Fauna Hawaiiensis, III, p. 665, 1910.

OAHU: Widely distributed, attached to *Pelea* (Perkins); Kawaihapai, 1928, 1930, on *Pelea,* Piko trail, 1933, on *Pelea,* Haleauau Valley, 1932, one on *Sideroxylon* (Swezey).

Proterhinus robustus Blackburn

Blackburn, Tr. Dublin Soc., III, p. 171, 1885.

Perkins, Fauna Hawaiiensis, II, p. 205, 1900.

OAHU: Haleauau Valley, Waianae Mts., 1930, on *Ipomoea* and *Pteralyxia* (Swezey); Halona Valley, 1933, on lantana and *Pteralyxia* (Swezey); Kamokunui Valley, 1933, on fallen kukui branches (Swezey).

Proterhinus ruficornis Perkins

Perkins, Fauna Hawaiiensis, II, p. 200, 1900.

OAHU: Kahana, 1931, on *Euphorbia,* Pauoa Flats, 1934, on *Gouldia* (Swezey).

Proterhinus serricornis Perkins

Perkins, Fauna Hawaiiensis, II, p. 195, 1900.

KAUAI: Halemanu (Perkins); Kokee, Aug., 1925, one doubtful specimen on each of *Gouldia elongata* and *Bobea mannii* (Swezey).

Proterhinus serricornis var.
KAUAI: Kokee, Aug., 1925, one large male on *Bidens cosmoides* (Swezey).

Proterhinus setulosus Perkins
Perkins, Fauna Hawaiiensis, II, p. 192, 1900.
KAUAI: Mts., 2500-4000 ft. (Perkins); Kokee, Aug., 1925, four specimens from dead stems of fronds of *Cibotium chamissoi* (Swezey).

Proterhinus sharpi Perkins
Perkins, Fauna Hawaiiensis, II, p. 213, pl. IX, fig. 17, 1900.
MAUI: Haleakala, 5000 ft. On undetermined fern (Perkins); Olinda, on *Cibotium,* 1926 (Swezey).

Proterhinus simplex Sharp
Sharp, Trans. Ent. Soc. London, 1878, p. 17.
Perkins, Fauna Hawaiiensis, II, p. 206, 1900.
OAHU: In both Mtn. ranges. Mt. Tantalus, on various trees (Perkins).

Proterhinus squamicollis Perkins
Perkins, Fauna Hawaiiensis, II, p. 201, 1900; F.H., III, p. 657, 1910.
OAHU: Koolau Range. On *Bobea elatior* (Perkins); Hauula, 1934, one from *Suttonia* (Swezey).

Proterhinus squamicollis var. **moestus** Perkins
Perkins, Proc. Haw. Ent. Soc., VII, p. 197, 1928.
OAHU: Lanipo, 1924, on *Pelea* (Swezey).

Proterhinus subangularis Perkins
Perkins, Fauna Hawaiiensis, III, p. 660, 1910.
HAWAII: Laupahoehoe, 1922, on *Straussia* (Swezey).
OAHU, MOLOKAI, MAUI, LANAI, HAWAII. Attached to *Straussia* (Perkins); Puu Kalena, 1929, on *Straussia,* Haleauau Valley, 1930, 1931, on *Straussia* (Swezey).
MAUI: Iao Valley, Mahena, 1926, on *Straussia* (Swezey).
MOLOKAI: Kawela, 1925, on *Straussia* (Swezey).

Proterhinus subdeceptor Perkins
Perkins, Fauna Hawaiiensis, III, p. 664, 1910.
OAHU: Koolau Range, on *Alyxia olivaeformis* (Perkins); Moanalua, 1930, Kawaihapai, 1930, Haleauau, 1932, 1933, Poamoho and Marsh trail, 1933, Kawailoa, 1934, all on *Alyxia* (Swezey).

Proterhinus subplanatus Perkins
Perkins, Fauna Hawaiiensis, II, p. 205, 1900; F.H., III, p. 660, 1910.
OAHU: Koolau Range, attached to *Straussia* (Perkins); several localities on *Straussia* (Swezey); Haleauau, 1 on *Peralyxia,* probably accidental (Swezey).

Proterhinus swezeyi Perkins
Perkins, Proc. Haw. Ent. Soc., IV, p. 347, 1920.

OAHU: Mt. Olympus, Sept., 1917, a single male on *Pritchardia* (Swezey). This must have been a straggler, for later collections were all from *Broussaisia arguta.* Mt. Kaala, 1927, 1928, 1932, Kahana, 1927, 1928, 1931, Mt. Olympus, 1935, Lanihuli, 1928 (Swezey).

Proterhinus tantali Perkins

Perkins, Proc. Haw. Ent. Soc., IX, p. 87, 1935.

OAHU: Mt. Tantalus, May 20, 1934, from dead twigs of *Euphorbia* (Swezey).

Proterhinus validus Sharp

Sharp, Trans. Ent. Soc. London, 1881, p. 531.
Perkins, Fauna Hawaiiensis, II, p. 212, pl. IX, fig. 16, 1900.

MAUI: Haleakala, 4000-5000 ft. On *Acacia koa* (Perkins).

Proterhinus vestitus Sharp

Sharp, Trans. Ent. Soc. London, 1878, p. 16.
Trans. Dublin Soc., III, 1885, pl. V, figs. 37, 38.
Perkins, Fauna Hawaiiensis, II, p. 205, 1900; F.H., III, p. 662, 1910.

OAHU: Mts. near Honolulu (Blackburn) (Perkins). *Aleurites, Dracaena, Pipturus, Charpentiera, Pisonia* (Perkins); *Ipomoea bona-nox* (Bridwell), Nuuanu Pali, 1917, on *Cordyline terminalis* (Bridwell), Arboretum trail, Manoa, 1926, on *Bobea elatior* (Swezey), Nuuanu Pali, 1925, on *Pipturus,* Mt. Tantalus, 1930, on *Pipturus,* 1935, on *Hibiscus,* Mt. Olympus, 1936, on *Cyanea angustifolia* (Swezey).

Proterhinus vicinus Perkins

Perkins, Fauna Hawaiiensis, II, p. 212, 1900; F.H., III, p. 665, 1910.

OAHU: Waianae Mts., Mt. Tantalus. On *Acacia koa* (Perkins); Piko trail, 1933, on *Coprosma,* Kukuiala Valley, 1933, on *Coprosma* and *Gouldia,* Kukuiala Valley, 1936, one on *Euphorbia* (Swezey).

Proterhinus vulcanus Perkins

Perkins, Fauna Hawaiiensis, II, p. 236, 1900.

HAWAII: Kona and Kau, 3000-4000 ft. (Perkins); Nauhi and Keanakolu, Sept.-Oct., 1931, from *Coprosma* and dead stems of tree fern, one from *Acacia koa* (Swezey and Williams).

Proterhinus wikstroemiae Perkins

Perkins, Fauna Hawaiiensis, II, p. 195, 1900.

KAUAI: Mts., 4000 ft., attached to *Wikstroemia foetida* (Perkins); Kokee, Aug., 1925, 13 specimens from *Wikstroemia furcata* (Swezey).

Proterhinus xanthoxyli Perkins

Perkins, Proc. Haw. Ent. Soc., VII, p. 511, 1931.

OAHU: Haleauau, Waianae Mts., Feb. 9, 1930, from dead branch of *Xanthoxylum* (Swezey); Palikea, Waianae Mts., Feb. 3, 1935, from *Xanthoxylum* (Swezey).

Identity of the Nutgrass Armyworm in Hawaii

BY O. H. SWEZEY
Experiment Station, H.S.P.A.

The caterpillars which of recent years we have been calling the nutgrass armyworm, are the larvae of a noctuid moth which has been going under the name *Spodoptera mauritia* (Boisd.). This species is recorded by Meyrick in Fauna Hawaiiensis, Vol. I, p. 152, 1899, without description, merely citing localities where collected by Perkins and Blackburn. A few of the specimens determined by Meyrick are in the Bishop Museum collection, and our pest agrees exactly with them. The name *Spodoptera mauritia* has therefore been widely used in reports and Hawaiian entomological literature without anyone questioning the identity of the species.

In studying the pests of Guam in 1936, an armyworm occurring in the rice seedling plots appeared to be very similar to our nutgrass armyworm. Its moth too, and its egg-laying habits were similar. On my return to Honolulu, and comparing specimens, it was found that there were two distinct species involved. On careful study the Guam species was found to agree with descriptions and figures of *Spodoptera mauritia* (Boisd.) in literature available (Hampson, Catalogue of Lepidoptera Phalaenae in the British Museum, VIII, p. 256, fig. 66, 1909; Hampson, Fauna of British India, Moths, Vol. II, p. 248, fig. 140, 1894). Thus the necessity arose of finding some other name for our nutgrass armyworm.

Some of the distinctions between the two species are the fringe of long hair on the fore tibia of the Guam species, a longer and larger fringe than in the Hawaii specimens; the orbicular spot on forewing is small and circular in the Guam species, larger, oval and oblique in the Hawaii form; there are differences in the lines on the forewing, though there is a general resemblance in color and pattern.

The particular characters mentioned seem to agree very well with figures of *Laphygma frugiperda* in U.S.D.A. Technical Bulletin 34, 1928, on "The Fall Armyworm". To make sure in this regard, specimens of the Hawaii species were sent to the Division of Insect Identification of the U. S. Bureau of Entomology and Plant Quarantine. There they were studied by Mr. J. F. Gates Clarke, who reported that there was superficial resemblance to *Laphygma frugiperda*, but there were distinct genitalia characters indicating it to be a different species, requiring further study.

Recently on looking up the species of *Laphygma* in Hampson's Catalogue of Moths of the British Museum, I find that he records *Laphygma exempta* (Walker) from Hawaii, mentioning several localities where collected by Perkins. It turns out that these are the

same localities of Meyrick's records for *Spodoptera mauritia* in Hawaii. The inference is apparent that Hampson has redetermined as *Laphygma exempta* the specimens which Meyrick recorded as *Spodoptera mauritia,* without so stating. Now comparing our material with Hampson's description and figure, I find them in agreement, and so it is apparent that our nutgrass armyworm should henceforth be known as *Laphygma exempta* (Walker).

According to Hampson, *L. exempta* is widely distributed in Africa, and in India, Ceylon, Singapore and Queensland, Australia. He also gives the distribution of *Spodoptera mauritia* as covering about the same range, and in addition: Mauritius, Java, Philippines, New Guinea, Tahiti and Marquesas. He gives no records of either species in America. His records of *Laphygma frugiperda* are all American, ranging all the way from Canada to Argentina, including the West Indies.

Biological Notes on the Pelagic Water Striders (Halobates) of the Hawaiian Islands, with Description of a New Species from Waikiki (Gerridae, Hemiptera)

BY ROBERT L. USINGER
University of California, Berkeley, Calif.

(Presented by O. H. Swezey at the meeting of December 3, 1937)

Halobates sericeus Eschscholtz has long been known from Hawaiian waters where it occurs on the surface of the open ocean or in the channels between the various islands. However, collections have more frequently been made after "Kona" storms when the bugs are swept up onto the beach at Waikiki by strong winds from the South. In an attempt to collect them under more placid conditions I had occasion to investigate the waters at Waikiki with the Marine Laboratory of the University of Hawaii as a base. Dr. C. H. Edmondson was a constant source of help and encouragement during the course of the investigation for which I am most grateful. Mr. W. E. China very kindly supplied a pair of *Halobates flaviventris* Eschscholtz from the collection of the British Museum of Natural History, thus greatly facilitating the establishment of the systematic position of the new species which was discovered.

ECOLOGY

As mentioned above, *Halobates sericeus* appears to inhabit the open ocean between the various islands. I have never encountered it within the protecting reefs near shore except during or right after severe storms when hundreds of stranded individuals may be found hopping about on the beach. Hadden[1] has recorded this at Waikiki during the southern "Kona" storms and Mrs. Violet Fosberg found them under the same circumstances at Kailua on November 30, 1935, after a storm from the North.

Halobates hawaiiensis, the apparently new species described below, occurs under very different conditions. Characteristically gregarious, thousands of nymphs are to be seen swimming about in compact groups within only a few feet of shore at Waikiki, especially in protected places. Adults are less frequently met with and may be seen coursing about individually out in deeper water but evidently always within the protecting reef which is here located about one quarter of a mile from shore. From September 1935 to April 1936 semi-weekly observations were made during which time the bugs were always to be found. There seemed to be no seasonal or tidal fluctuation in numbers but during heavy seas the nymphs

[1] Hadden, F. C. The Pelagic Halobates. Proc. Haw. Ent. Soc., 7:457, 1931.

in particular retreated to protected coves where they were sometimes collected within a few inches of the sea wall.

During most of the period mentioned some specimens were kept in an aquarium approximately four feet long and one foot wide equipped with running sea water. Although such confined conditions were obviously very unsatisfactory for the bugs, certain interesting facts were noted. An initial population of several hundred first instar nymphs usually resulted in three or four adults, as *Halobates* are fiercely cannibalistic. Indeed, the only feeding I ever observed either in captivity or under natural conditions was of this sort. As soon as a bug weakens and is seen to falter it is attacked by its fellows. Flies and other insects recently killed and pieces of fresh crab meat were provided at various times but I never saw a bug feed on this material. It is possible that feeding occurred during darkness, however. Copulation occurred frequently but the females never laid eggs on any of the objects such as pieces of cork, feathers, pieces of wood, etc., provided for the purpose. That an egg must have been laid, however, is obvious from the following incident. During a two weeks trip to another island the rearing was discontinued, the bugs were removed and the water was turned off in the aquarium. Upon my return a single very small first instar nymph was seen swimming on the smooth surface of the water which had been undisturbed for two weeks. From this I conclude that there must have been at least one egg hidden perhaps in a rough coral rock at one end of the aquarium. It is interesting in this connection that no eggs were ever observed on floating objects such as feathers, etc., as described for certain of the species occurring in the open ocean. Fully formed eggs were dissected from gravid females of this and another reef-frequenting species in the Pacific so it is inconceivable that among the thousands of individuals some eggs would not have been laid. A fruitless search was made for eggs concealed along the shore but it is still believed that they will be found in cracks and holes in the rough coral rocks. Delsman[2] has described *Halobates* eggs in great detail and has observed hatching as well as certain embryological details.

Halobates have been collected at sea during the night time by lowering a lantern near the surface, thus suggesting a positive phototropism. Attraction to light was frequently observed in my aquarium, one end of which was next to a window while the remaining portion extended along the wall in comparatively poor light. Whenever a new group of bugs was introduced they all crowded toward the light, jumping over each other and repeatedly bumping against the glass side of the aquarium.

The reputed diving ability of these bugs is a subject of consid-

[2] Delsman, H. C. On the propagation of Halobates. Treubia, 8:384, 1926.

erable controversy. Thus Murray,[3] Walker,[4] and Henry[5] state positively that these bugs dive beneath the surface, while Hay[6] and Delsman[7] were unable, under any circumstances, to induce them to dive. My own observations are as follows. Neither in captivity nor under natural conditions was I ever able to force *Halobates* nymphs or adults to dive beneath the surface. In Micronesia I have stood in shallow water amidst many thousands of these bugs and have tried in every way to frighten them or force them to dive. They jump frequently and may move in this way so quickly that they seem to disappear. On the other hand I took a glass plate and forced a number of individuals a foot or two below the surface, holding them there to observe their actions. They were able to swim with very jerky, awkward movements first downward, thence out beyond the edge of the glass and up toward the surface where they quickly broke through the surface film to freedom.

TAXONOMY

Halobates species have long attracted the attention of voyaging naturalists. Literature on the group was brought together by Buchanan-White in 1883 in his well known Report on the Pelagic Hemiptera of the Challenger Expedition. Since that time a good many names have been proposed, many of which have since been relegated to synonymy. It seems likely that others are destined to a similar fate when the types of inadequately described species are examined. On the other hand recent exploration seems to be turning up many new and perfectly valid species which suggests a much more local distribution than was formerly thought to be the case with these bugs. The recent work of Imms[8] has set a style for more precise descriptions which, in the future, should do much to place the taxonomy of these bugs on a sound basis. The apparently undescribed Hawaiian species is characterized below.

Halobates hawaiiensis Usinger, n. sp.

A large, relatively slender, steel-gray species with the apical three antennal segments in the proportion 13:9:11 in the male and 11:9:12 in the female. The basal segment of the anterior tarsus is shorter than the second, 9½::12½. The mesonotum bears short, scattered, stiff black bristles on either side of the middle while the posterior acetabula are beset with long black bristles dorsally which become quite dense posteriorly. The styliform processes of the male are bent asymmetrically (figures 1 and 2). The ochraceous markings

[3] In Buchanan-White, F. Report on the Pelagic Hemiptera. Rept. Voy. Challenger, p. 73, 1883.

[4] Walker, J. J. On the Genus Halobates and Other Marine Hemiptera. Ent. Mo. Mag., (2) 4:227-232, 1893.

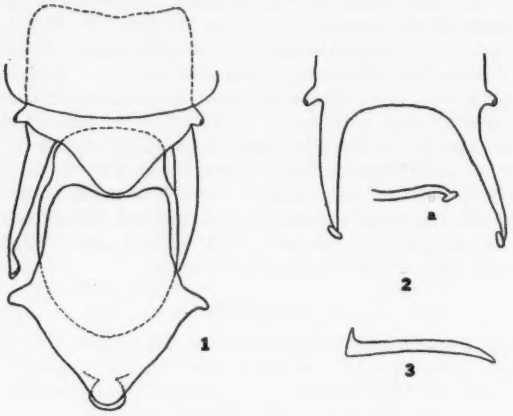
[5] Henry, G. M. Note on the Diving Powers of Halobates. Spolia Zeylanica, 16:353-354, 1932.

[6] In Buchanan-White, F. Report on the Pelagic Hemiptera. Rept. Voy. Challenger, p. 74, 1883.

[7] Delsman, H. C. On the Propagation of Halobates. Treubia, 8:384-388, 1926.

[8] Imms, A. D. Sci. Rept. John Murray Exped., 4:71-78, 7 figs., 1936.

of the ventral surface are confined to portions of the abdomen, the acetabular sutures only appearing slightly pale while the rest of the mesosternum and acetabula are concolorous.



Halobates hawaiiensis

Figure 1, apical abdominal segments of male seen from above.
Figure 2, posterior portion of eighth abdominal segment, ventral view, showing styliform processes, 2a, lobed tip of a styliform process in side view.
Figure 3, paramere in side view.

Male. Antennae less than two thirds as long as body, 71::117, the proportion of segments one to four as 39:13:9:11. Pronotum with sides subrounded, much shorter than head on median line, 9::21, the posterior margin shallowly, concavely arcuate. Mesonotum anteriorly abruptly roundly angled; width just behind anterior angles greater than width of head including eyes, 35::33, gradually increasing in width posteriorly, 35::43, the sides subrectilinear and superficially appearing subparallel; short, stiff, postero-laterally directed black bristles sparsely scattered anteriorly and laterally on dorsal surface and sometimes extending almost to bases of posterior acetabula on either side. Posterior acetabula with longer black bristles becoming quite dense posteriorly. Anterior tarsus with basal segment distinctly shorter than second, 9½::12½. First segment of intermediate tarsus three and one half times as long as second, 46::13. Intermediate femora distinctly longer than posterior femora, 27::23. With only a half a dozen short, stiff bristles on posterior surface of intermediate femora and a much shorter fringe on tibiae and tarsi than in *flaviventris*. Eighth abdominal segment above asymmetrically produced, roundly emarginate on left side of apex and roundly produced a little to the right of middle (figure 1). Styliform processes (figures 1 and 2) very asymmetrical, the left process scarcely longer than the right, bent outward beyond the level of lateral projection at middle of ninth segment, sinuate and partially visible from above. Right process turned inward and consequently invisible at apex as seen from above. Apices of styliform processes lobed (figure 2a). Ninth segment (figure 1) about as broad as long, distinctly,

narrowly, and slightly backwardly produced, the posterior portion with sides nearly rectilinear and distinctly converging, apex subrounded. Parameres very small and apparently alike (figure 3).

Color in great part blue-black with fine gray pubescence, an obscure longitudinal line at middle of dorsum of thorax and base of abdomen, the rostrum, antennae, spots of dorsum of head characteristic of the genus, gula, legs, outer margins of anterior acetabula and genital segments black. Basal markings of head characteristic of the genus and third to seventh abdominal segments below ochraceous, the coloration of venter largely confined to center, the first two segments and sides of segments three to seven as well as bases of seventh and eighth segments brown to black. The eyes and sutures of intermediate acetabula brown. Length 4.87 mm., greatest width 1.79 mm.

Female. Differs from the male in its very much broader form, the sides of mesonotum being more strongly dilated posteriorly and more rounded throughout and the stiff bristles of mesonotal disk longer and more confined to anterior region. Antennae proportionately a little shorter than in the male, length compared with body length 61::102, the proportion of segments one to four as 30:11:9:12. Posterior trochanters each densely provided with stiff black hairs which are backwardly or inwardly directed and longer than greatest diameter of a trochanter.

Color much as in the male but with abdominal segments one to six yellow, seven ochraceous at middle and brownish laterally, the terminal segments black. The sutures and interior margins of intermediate acetabula narrowly ochraceous. Length 4.25 mm., greatest width 2.17 mm.

Holotype, male, Waikiki, Oahu, T. H., Nov. 6, 1935, R. L. Usinger collector. Allotype, female, same locality as type, Sept. 23, 1935. Paratypes: three males, same data as holotype; one male and one female, same data as allotype; two males, Oct. 26, 1935; and one female, Sept. 16, 1935, all collected by the writer; one male, Dec. 21, 1927, M. Maneki collector. A single damaged specimen from the same locality has been seen in the collection of the United States National Museum. Type material deposited in the collection of the B. P. Bishop Museum except for paratypes which are deposited in the British Museum (Natural History), the United State National Museum and my own collection.

There is some variation in the extent of the stiff black bristles of the sides of the thorax. In the paratype collected by Maneki three small bristles are to be seen on the sides of the pronotum and they extend along the entire length of the mesonotum on either side to the bases of the posterior acetabula.

Hawaiiensis runs to the group including *flaviventris, hayanus,* and *proavus* in Buchanan-White's key but differs from all of these in the possession of stiff black bristles of the thoracic disk and posterior acetabula. I know of these bristles only in a species from the Marianas Islands in Micronesia and in an apparently undescribed Polynesian species. *Flaviventris* differs in addition in its more robust form, subequal anterior tarsal segments and flavous under surface of intermediate acetabula. *Hayanus* differs in its smaller size, shorter basal segment of anterior tarsus, yellowish under sides of intermediate acetabula and symmetrical styliform processes.

Other species which might be confused with *hawaiiensis* differ as follows: *micans* has the left styliform process bent abruptly upward; *proavus* differs in its smaller size, especially the male, yellow intermediate acetabula below, very stout styliform processes and (see Esaki, 1926 and 1930)[9] much smaller basal tarsal segment of front leg; *sobrinus* has the eighth abdominal segment above much more strongly produced laterally while the under side of the abdomen is much darker in color; *germanus* is smaller with the bases of the legs reddish brown and the eighth abdominal plate above with rounded sides; *sewelli* differs in the shorter and inwardly directed left styliform process and subrounded sides of eighth abdominal plate; *splendens* has subequal anterior tarsal segments and the second segment of intermediate tarsus is only one sixth as long as first; the Australian *whiteleggei* is smaller with the yellowish color of abdominal area greater in extent, with a shorter basal segment of anterior tarsus and with symmetrical styliform processes; *regalis* differs in its larger size and symmetrical styliform processes.

As mentioned above, the only other species as yet met with in Hawaiian waters is *sericeus*, a species which is only three mm. in length with the second antennal segment scarcely more than one half the length of fourth segment. The first segment of the anterior tarsus is much shorter than the second and the styliform processes are long, slender, and symmetrical. The color is uniform gray with black appendages, eyes, genital segments, etc. while only the two obscure markings of vertex are ochraceous.

During the course of this investigation it was necessary to draw up a list of the described species and their synonyms. Previous lists have been published by Bergroth[10] and Lethierry and Severin[11] toward the close of the last century. So much additional information has accumulated since that time that I have considered it advisable to offer my list in the hope that it will facilitate further work in this group. Only original citations are given except in cases where subsequent papers contain new synonymic or descriptive matter. The localities are often given in rather general terms because many detailed records are certainly based upon misidentification. More specific localities are given for the Pacific where these are fairly certain. Original sources have been checked in all cases except Dahl (1893), Nasonov (1897), and Schadow (1922).

List of the Species of Halobates with Synonymy and Distribution

1. FLAVIVENTRIS Eschscholtz, 1822, Entomographien, 1:109, Tab. II, fig. 5. Esaki, 1928, Ann. Mag. Nat. Hist. (10), 2:513 (=*herdmani* Carpenter).
   herdmani Carpenter, 1906, Ceylon Pearl Oyster Fisheries: Suppl. Rep. 32:151-156, 1 plate.
   Distribution:—Atlantic and Indian Oceans.

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[9] See synonymic list below.
[10] Bergroth, E. Revue d'Ent., 12:206, 1893.
[11] Lethierry, L. et Severin, G. Cat. Gén. Hémiptères, 3:65-66, 1896.

2. FORMIDABILIS (Distant), 1910, Ann. Mag. Nat. Hist. (8), 5:147 (*Euratas*).
   Distribution:—Andaman Sea, India.
3. FRAUENFELDANUS B. White, 1883, Rept. Voy. Challenger, Zool., VII, pt. 19, pp. 57-58, Pl. II, fig. 3.
   Distribution:—Indian Ocean.
4. GERMANUS B. White, 1883, Rept. Voy. Challenger, Zool., VII, pt. 19, pp. 50-52, Pl. I, fig. 6.
   Distribution:—Pacific Ocean (New Caledonia), China Sea and Celebes Sea.
   var. BANKAE Griffini, 1895, Boll. Mus. Torino, X, No. 213, p. 3.
   Distribution:—Stretto di Banka.
5. HAYANUS B. White, 1883, Rept. Voy. Challenger, Zool., VII, pt. 19, pp. 52-54, Pl. I, fig. 8. Dahl, 1893, Ergebn. d. Plankton Exped., II, G. a, pp. 6-7 (=*incanus* Witlaczil).
   incanus Witlaczil, 1886, Wien. Ent. Zeit., 5:179-181, fig. 2.
   Distribution:—Red Sea, New Guinea, and Malay Peninsula.
6. INERMIS Dahl, 1893, Ergebn. d. Plankton Exped., II, G. a, pp. 6-7, figs. 4, 5, 7, and 8.
   Distribution:—Atlantic Ocean.
7. JAPONICUS Esaki, 1924, Psyche, 31:115-116, Pl. V, fig. B.
   Distribution:—Japan (Coast of Provinces of Sagami, Kii, and Tosa).
8. KUDRINI Nasonov, 1893, Ent. Researches, Warsaw, pp. 1-24, 1 Plate, figs. 11 and 12 (as var. of *flaviventris*). See Zool. Centralb., 1:702, 1894. Esaki, 1928, Ann. Mag. Nat. Hist., (10), 2:513 (as a distinct species).
   Distribution:—India.
9. MACULATUS Schadow, 1922, Hamburg Univ. Diss., p. 2.
   Distribution:—Bismarck Arch.
10. MARIANNARUM Esaki, 1937, Tenthredo, 1:357, Pl. 31, fig. 1, text-fig. 2.
    Distribution:—Marianas Islands (Rota and Guam).
11. MICANS Eschscholtz, 1822, Entomographien, 1:107, Tab. II, fig. 3. Dahl, 1893, Ergebn. d. Plankton Exped., II, G. a, pp. 6-7 (=*wullerstorffi* Frauenfeld).
    wullerstorffi Frauenfeld, 1867, Verh. K. K. Zool. bot. Ges., Wien, 17:458, Tab. 12.
    Distribution:—Atlantic, Pacific, and Indian Oceans (Palmyra, Marquesas, Formosa, and Galapagos Islands).
12. MJOBERGI Hale, 1925, Ark. Zool., 17 A, No. 20, p. 12, fig. 7.
    Distribution:—Northwestern Australia.
13. PRINCEPS B. White, 1883, Rept. Voy. Challenger, Zool., VII, pt. 19, pp. 44-45, Pl. 1, fig. 3. Esaki, 1926, Ann. Mus. Nat. Hung., 23:133 (=*alluaudi* Bergroth). Esaki, 1928, Insects of Samoa, 2:74 (=*matsumurai* Esaki).
    alluaudi Bergroth, 1893, Revue d'Ent., 12:204-205.
    matsumurai Esaki, 1924, Psyche, 31:117-118, Pl. 5, fig. D.
    Distribution:—Indian and Pacific Oceans (Samoa).
14. PROAVUS B. White, 1883, Rept. Voy. Challenger, Zool., VII, pt. 19, pp. 54-55, Pl. II, fig. 1. Esaki, 1930, Jour. Federated Malay Museums, 16:17, (=*rotundatus* Esaki).
    rotundatus Esaki, 1926, Ann. Mus. Nat. Hung., 23:131-132, fig. 4.
    Distribution:—West Pacific Ocean and Red Sea.
15. REGALIS Carpenter, 1892, Proc. Royal Dublin Soc., 7:144, Tab. 13, figs. 1-8.
    Distribution:—Torres Straits (Island of Mabuiag).

16. ROBUSTUS Barber, 1925, Zoologica, 5:253-254, fig. 50.
Distribution:—Galapagos Islands (Conway Bay, Indefatigable Island).
17. SERICEUS Eschscholtz, 1822, Entomographien, 1:108, Tab. II, fig. 4.
Distribution:—Pacific and Atlantic Oceans (Hawaii).
18. SEWELLI Imms, 1936, Sci. Rept. John Murray Exped., IV, No. 2, pp. 71-78, 7 figs.
Distribution:—Gulf of Oman, Red Sea.
19. SEXUALIS Distant, 1903, Fascic. Malayenses, Zoology, 1:258, Pl. XV, fig. 10.
Distribution:—Malay States (Estuary of Jambu River).
20. SHIRANUI Esaki, Psyche, 1924, 31:114-115, Pl. 5, fig. C.
Distribution:—Japan (On Coast of East China Sea, Province of Hizen).
21. SOBRINUS B. White, 1883, Rept. Voy. Challenger, Zool., VII, pt. 19, pp. 46-47, Pl. 1, fig. 5.
Distribution:—Pacific Ocean (Tahiti, Marquesas, and Tuamotus).
22. SPLENDENS Witlaczil, 1886, Wien. Ent. Zeit., 5:178, fig. 1.
Distribution:—Pacific Ocean near the Galapagos.
23. STREATFIELDANUS Templeton, 1836, Trans. Ent. Soc. Lond., 1:230, Pl. 22, fig. A.
Distribution:—Atlantic Ocean.
var. MAGENTAE Griffini, 1895, Bol. Mus. Torino, X, No. 213, p. 4.
Distribution:—Mare di Valparaiso and Mare del Chili.
24. WHITELEGGEI Skuse, 1891, Rec. Austr. Mus., 1:174-177, Pl. 27, 10 figs. Skuse, 1892, Rec. Austr. Mus., 2:44 and 45.
Distribution:—East Coast of Australia.

APPENDIX

Since the above manuscript was submitted, an abstract of Schadow's paper entitled "Die Gattung Halobates Esch. und die Beziehungen der Meeres- und Susswasser-hydrometriden zueinander", Hamburg University Dissertation, 1922, 5 pages, has come to hand thanks to the exchange facilities of the University of California Library. The paper is divided into three Abschnitten: the first dealing with systematics, synonymizing *H. inermis* Dahl with *H. micans* Esch., and describing *H. maculatus* n. sp.; the second dealing with the geographical distribution of *Halobates;* and the third analysing the relationships between the oceanic and fresh water Hydrometridae [Gerridae]. The original description of *Halobates maculatus* Schadow, is copied below for the convenience of those who may not have access to the original work.

"Mittelschenkel mit vielen kräftigen Dornen zwischen den Haaren; Fühlerglieder 1-3 mit einzelnen längeren, starken Dornen zwischen den gewöhnlichen; 2. Vorderfussglied über 3 mal so lang als das erste; distales Drittel des ersten Mittelfussgliedes ohne Langborsten; gelbe Kopfflecke auffallend gross, ihre Vorderecken in Höhe des vorderen Augenrandes.

Länge: Männchen 2,1-2,3 mm, Weibchen 3,0 mm.

Breite: Männchen 1,3-1,4 mm, Weibchen 1,9-2,0 mm.

Anzahl der untersuchten Stücke: 3 Männchen, 3 Weibchen.

Fundort: Bismarckarchipel: 'St. Matthias, Ekalin, im Baumschatten auf einem Salzwasser unmittelbar am Ufer.' (Dr. Dunker.) Ekalin ist ein kleines Korallenriff mitten im Ozean."

Biological Studies in Hawaiian Water-Loving Insects

PART III

Diptera or Flies

A, EPHYDRIDAE AND ANTHOMYIIDAE

BY FRANCIS X. WILLIAMS
Experiment Station, H.S.P.A.

(Presented at the meeting of December 3, 1937)

Biological studies in Hawaiian water-loving Diptera were begun late in 1929 and have continued—with many interruptions—up to the present time. None of these studies is in any way complete, so that future investigators in this subject will find much work both in the laboratory and in the field awaiting them. Most of my observations were made on the Island of Oahu, with Hawaii the largest Island of the group and the last to appear above the waves, ranking next in number of field studies.

The subject is replete with interest and not without its practical value. From its study we gain a better knowledge of denizens of the seashore, of lowland streams, ponds and marshes, of mountain waters and water-holding plants, and we must ascend even to heights of many thousands of feet above the level of the sea, in regions of subarctic climate in order to add to our knowledge of the few water-loving Diptera that appear at these elevations. The early stages of some of our flies may be passed in sewage, a few may affect our water supply, others are a nuisance at our lights and the mosquito is never welcome. Some may be beneficial and in some regions the larvae of certain midges are of value as fish food.

To definitely separate those water-loving flies that are subaquatic in one or more stages, from those that are terrestrial, rests in many cases with the worker's definition of these two terms as well as with the vagaries of certain of the flies themselves.

The writer has derived much assistance from the works of other entomologists. Among these are: Bryan, E. H., Jr., A Review of the Hawaiian Diptera, with Description of New Species, Proc. Hawaiian Entom. Soc. VIII, pp. 399-468, 1934; Johannsen, O. A., Aquatic Diptera, Part I, Nemocera, exclusive of Chironomidae and Ceratopogonidae. Cornell University Agric. Exp. Sta., Mem. 164, 1-71, pls. I-XXIV, 1934; Part II, Orthorrhapha-Brachycera and Cyclorrhapha, ibid, Mem. 177, 1-62, pls. I-XII, 1935; Part III, Chironomidae, Subfamilies Tanypodinae, Diamesinae, and Orthocladiinae, ibid. Mem. 205, 1-84, pls. I-XVIII, 1937; Karny, H. H., Biologie de Wasserinsekten, I-XV

& 1-311, 160 textfigs, Wien, 1934; and Séguy, E., Diptères Anthomyides, Faune de France, 6, XI & 393, 813 figs., 1923; Dipteres (Brachyceres), Faune de France, 28, 832 pp., 27 pls. and 903 figs., Paris, 1934. Thanks are due to Mr. E. T. Cresson, Jr. of the Academy of Natural Sciences of Philadelphia for naming some of the ephydrid flies, and to Mr. E. H. Bryan, Jr., for similar work in other Diptera.

FAMILY EPHYDRIDAE (INCLUDING THE CANACINAE)

Seventeen species of this family are now recorded from the Hawaiian Islands. Over half of these appear to be endemic. Several are peculiar to the seashore. At least two are leaf-miners in the larval stage. Our most aquatic species is probably *Brachydeutera hebes* Cress. The largest genus is *Scatella* with six described species.

The Ephydridae are a large though rather heterogenous assemblage of flies that exhibit great diversity in habits. Thus, the genus *Ochthera* and its immediate allies with greatly developed forelegs are evidently predacious. Many ephydrids feed by lapping wet surfaces, while their larvae consume decaying plant tissues, etc. A number of species mine the leaves and stems of aquatic or semi-aquatic plants, the adult fly in one case at least, scraping off the living tissues of the larval food-plant. The larva of the "petroleum fly", *Psilopa petrolei* Coq., is found in pools of crude petroleum in California, breathing by means of its posterior spiracles thrust above the surface of the oil. Its food seems to be chiefly foreign organic matter found in this medium (Crawford, D. L., Pomona Journ. Sci., IV, pp. 687-697, fig. 222, 1912; Thorpe, W. H., Trans. Entom. Soc. Lond., LXXVIII, pp. 331-343, 4 figs, & pls XXVIII & XXIX, 1930). The larva of the common European *Teichomyza fusca* Macq. frequents out-of-door urinals and excrement. It is noted for its highly developed thoracic respiratory organs (Vogler, C. H., Illus. Ztschr., Ent. 5: 1-4, 17-20, 33-36, 1900). Species of the genus *Ephydra* breed—often in immense numbers—in saline and alkaline waters and are able to adapt themselves to great fluctuations in the density of these waters. *Ephydra hians* Say frequently enters the water enveloped in a globule of air to lay its eggs. The larva of this and of some other species develop at some depth under water, not coming to the surface for air, the long posterior process and its filaments evidently functioning as trachaeal gills (Aldrich, J. M. The Biology of Some Western Species of the Genus Ephydra. Journ. N. Y. Entom. Soc., pp. 77-98, 3 pls, 1912). A few Ephydridae are known to breed in hot springs. (For *Ephydra*, see Brues, C. T. Proc. American Acad. Arts and Sciences, 59, 1924, 63, 1928 and 67, 1932, and for *Scatella*, see Matsumura, S., Konch. Sek. Gifu, 19, 223-225, 1915, = *Scatella calida* Mats. (I have not seen this paper. F.X.W.), and Tuxen, S. L., Opuscula Entomologica, I, pp. 105-111, 1936, = *S. stagnalis* (Fall.) and *S. thermarum* Collin, the

latter regarded by Tuxen as a form of *stagnalis*). The widespread *Scatella stagnalis* (Fallen) occurs in such extremes of climate as Greenland and Alaska as well as in some of the tropical islands of the Pacific.

With reference to the Ephydridae found in the Hawaiian Islands, no study was made of the biology of the following species: *Discomyza maculipennis* Cresson, a pantropic insect which has been bred from improperly cleaned and dead sea shells (Bryan, E. H. Jr., Proc. Haw'n. Entom. Soc., VI, 236, 1926); *Atissa antennalis* Aldrich, *Hecamede albicans* (Meig.) and *Hecamede persimilis* Hend., occurring at the seashore; *Paralimna insularis* (Grims.), *Lytogaster aldrichi?* Cresson, and one or two others. The investigations in all cases leave much to de desired and this refers particularly to the interesting genus *Scatella*.

Hydrellia williamsi Cresson. (Plate I)

Cresson, E. T. Jr., Trans. Am. Entom. Soc., LXII, pp. 259-261, 1936.

The writer remembers years ago in a public garden of a tropical South American city how a little child bent on exploration, wandered from the family group and, stepping forth boldly towards what appeared to be a smooth level piece of sward, soon found himself floundering in a pond coated over to invisibility with a myriad little duckweed plants.

More successful in its explorations of such a growth of duckweed or *Lemna*, is the tiny *Hydrellia williamsi* fly, a millimeter and a half long, with a silvery white face, a generally shining black body and the legs in large part yellowish brown (Pl. I, 1). Well raised on legs drawn close to the body, it moves over this relatively vast floating field of close-set and overlapping bright green lobes, with seeming care or hesitancy, now stopping for a moment, following one of its fellows a short distance or advancing in a sideways manner. It can wheel about quickly, and at one's too near approach will make a very short flight.

The delicately ribbed whitish eggs of *Hydrellia* (Pl. I, 3) are somewhat less than half a millimeter long. In hatching, the tiny larva cuts a gash-like opening at the broader end of the egg and by means of a pair of very finely toothed mouth-hooks (Pl. I, 4, D) soon works its way into a *Lemna* leaf. At first its body is nearly transparent but under sufficient magnification we can easily see these darkly chitinized mouth-hooks hinged to the fore end of a dusky head skeleton, scraping down the chlorophyll or green matter upon which it feeds, and leaving a trail or mine with semi-transparent walls as it progresses. As it increases in size and voracity its mines become broader and more irregular, with here and there matter voided from the intestine. It passes from one leaf to the other and then to an adjoining plant, but does not consume the entire leaf content. A larva that was followed in its

development of about 9 or 10 days worked through 15 large and several small leaves. Two exuviae or moult-skins were found in the mines. The third exuviae of course, consists of the puparium after the pupa is formed within it. Bands of exceedingly fine setulae girdle the fore part of the larva; posteriorly the bands may thin out or disappear on the sides, but are accentuated as rows of setulae on the pseudopods and on the last segment. The last segment bears two processes each terminating in a dark, sharply conical hollow spine into the base of which passes a longitudinal tracheal tube (Pl. I, 5). One sometimes may see the larva perforating or pushing apart the leaf walls with these sharply pointed cones, establishing thereby an air connection with its caudal spiracles. The puparium (Pl. I, 2 and 6) though somewhat flattened may cause quite a bulge in the floating leaf in which it rests venter upwards. The pupa shows rather darkly within its air-gilded container. The head end of the puparium may protrude very slightly from the edge of the leaf in which it lies, or the walls of this more or less disintegrating leaf are somewhat agape. Thus the emerging *Hydrellia* fly, pushing off the lid of the puparium by means of a temporarily swelled forehead, readily crawls out and onto the leaf and there completes its development. Its tongue extended downwards, wings pad-like, thickish and wrinkled, the fly assiduously brushes itself with fore and hind legs; the hairs stuck flat on the abdomen soon assume a semi-erect position, the tongue is folded back and the wings attain their full size though remaining pallid for some time. About 18 or 19 days were required for the entire life-cycle, in the single case observed.

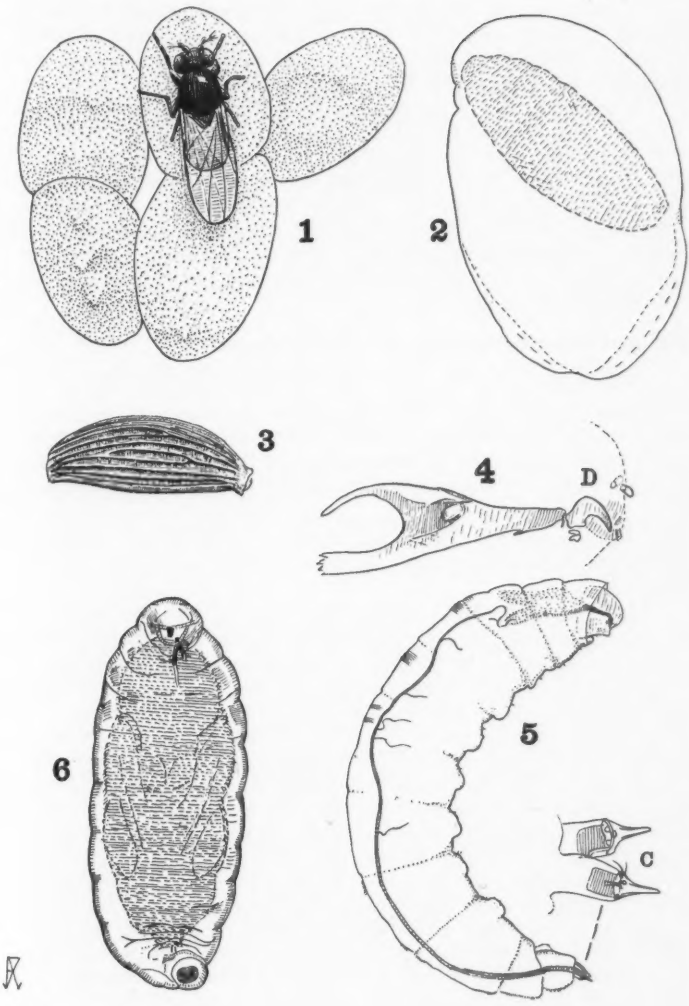
A probable parasite of this tiny fly is *Habrolepis* sp. (Encyrtidae), a chalcidid wasp with prettily spotted wings that appeared in a jar of *Lemna* in which *Hydrellia* was breeding.

This fly has much the same habits as *Lemnaphila scotlandae* Cress., another tiny ephydrid the life-history of which has been studied by its discoverer (Scotland, Minnie B., The Animals of the Lemna Association : Ecology, XV, pp. 290-294, 2 figs., 1934). To quote this author regarding the feeding habits of the adult *Lemnaphila:* "As soon as it has spread its wings it begins to eat out characteristic parallel channels in the upper surface of the thallus. This is accomplished by several rows of teeth that can be extended or re-

HYDRELLIA WILLIAMSI.

Explanation of Plate I.

1. Adult fly on a *Lemna* plant.
2. *Lemna* leaf showing in outline a puparium within.
3. Egg, from the side.
4. Cephalo-pharyngeal skeleton, palps and antenna of larva.
5. Larva, from the side; at C, caudal processes more enlarged. Probably in last instar.
6. Puparium showing pupa within, ventral view. Length 1.8 mm.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tracted within the labellum." This is in keeping with the lapping or scraping method of feeding employed by the Ephydridae in general.

Hydrellia williamsi was first taken on Lemna-covered water at Kanoa, Molokai, on June 1, 1931 (2 specimens). Series of adults as well as life-history notes were obtained from Waianae village and Kukuiala valley, Waianae Mts., Oahu, early in 1936.

A second and larger species, *Hydrellia hawaiiensis* Cresson (Trans. Am. Entom. Soc., LXII, pp. 263-264, 1936) is found on the algal mats largely composed of *Enteromorpha* sp. in a reservoir and cement ditch of Waianae Company sugar plantation. This fly can walk freely upon water. Nothing was learned of its immature stages aside from a few eggs obtained from captive specimens. The egg much like that of *H. williamsi* is yellowish white and ribbed, but is somewhat larger, measuring about 0.53 mm. (Pl. VI, 44 and 45). The wing is shown in fig. 43.

Brachydeutera hebes Cresson. (Plates II and III)

Cresson, E. T. Jr., Proc. Haw'n Entom. Soc., VI, p. 277, 1926.

From shallow, often brackish puddles by the sea to mountain bogs a mile or more above them; in the rain barrel, the water-filled tree hollow, the tiny canyon pool; on such diverse quiet waters as these the stout-bodied, silvery-and-brown *Brachydeutera* fly may be found. In the open sunshine this insect, a trifle smaller than the common house-fly, is readily seen, in the forest's shadows the shining overlapping wings help mark it on the surface of the dark waters.

This adaptable fly is particularly abundant in the lowlands. Here are puddles; shallow, fishless and set in coral basins, sheltered to some extent by the thin foliage of the algaroba tree (*Prosopis juliflora* [Sw.], Leguminosae), so that the bottoms of these puddles are carpeted with leaflets in various stages of decay. In such places *Brachydeutera* often breeds in numbers, sharing its abode with the larva of the night mosquito (*Culex quinquefasciatus* Say), with the bloodworm—larva of the midge (*Chironomus hawaiiensis* Grimshaw) — with minute crustaceans, *Tubifex* worms and other small organisms. On opaque muddy pools near Ewa, Oahu, swarms of hundreds of these ephydrid flies have been seen seeking the scant shadows of half-submerged branches and, if not clinging to some object, hopping forward occasionally when a gust of air threatened to push back their ranks. We have seen adult *Brachydeutera* strung out in more hundreds on scummy water and along wet banks on the shaded side of a ditch impregnated with filter-press mud foul enough to provide a breeding place for the shrill-humming, bee-like drone-fly, *Lathryophthalmus arvorum* (Fabr.). A shaded puddle at the base of a compost heap, the drip from a leaky pipe line, a quart or two of rain water

accumulated in an old, partly sheltered wash-boiler, will often suffice for *Brachydeutera* to go through its rapid metamorphosis. On windward Oahu the adult has been found on standing irrigation water in a low cane field. In the woods and mountains we may find it in detached little pools layered with decaying leaves, and perhaps containing fruits of the guava (*Psidium guajava* L.) and of the candlenut or *kukui* (*Aleurites moluccana* [L.]), as well as in the *kukui* tree water-filled hollow, where breed also the commoner day mosquito (*Aedes albopictus* (Skuse)), moth- flies and one or two other Diptera. It persists at higher elevations, and here the fly has been known to reproduce in a gallon kitchen pot half full of water—as the writer observed in a yard on the slopes of Mauna Kea, Hawaii—at an elevation of about a mile. Going higher still, there is a record (August, 1929) of finding several of these flies perched on water in a rain barrel at an elevation of about 6300 feet, on the slopes of Hualalai, Hawaii. At least once (October 5, 1931) the adult fly has been taken riding the waters of Lake Waiau, at an elevation of 13,007 feet above sea-level on the bleak heights of Mauna Kea, our loftiest mountain (13,784 feet). But despite the great adaptability of the fly to various situations, it may be absent from pools apparently well suited to it and where its smaller, less aquatic, and often sun-loving relative, *Scatella,* thrives. Or we may find it plentiful at one time and absent at another.

As *Brachydeutera* rests upon the water (Pl. II, 7), the tarsi or feet of usually all three pairs of legs impress the surface film, but the burden falls chiefly upon the outspread middle pair, since these legs may serve as a fulcrum while the insect lifts and cleans its fore and hind paws or brushes its body; the latter, by the way, is held quite clear of the water. The tarsi are provided on their underside with fine hairs the free ends of which are so bent as to lie more or less for their length upon the surface of the water and thus must form a large buoying-up area (Pl. II, 9). Such hairs bent at their tip were found poorly developed in *Scatella,* an ephydrid less adept than *Brachydeutera* upon the surface of the water. They were noted upon the tarsi of the water-skating dolichopodid *Campsicnemus miritibialis* V.D., but particularly upon *Hydrophorus.* These modified hairs are not present on the tarsi of *Musca domestica,* the common house-fly.

When the water is still, so usually too *Brachydeutera* makes little movement, at least when in small numbers. If disturbed it takes a short, rather elevated flight to a safer place on the water, or alights on the water's edge. At leisure, it may walk on the surface or progress by a very short winged dash. It is not a strong flier.

The fly is easily kept in captivity and, properly cared for, may live for several weeks. It will often remain for a day or more in a

moderately deep uncovered dish partly filled with water and placed by the window. It seems almost forever to be lapping the surface of the water with rapid strokes of its large tongue-like organ or labella which terminates the proboscis (Pl. II, 12). By moving this bilobed labella, its free surface skims the water, gathering by means of incomplete, basally-converging tubes (food channels) or pseudotracheae thereon, materials fine enough to pass through them and thence into the gullet. The large oral cavity houses the proboscis, which folds in and against it and is not then, the place into and through which food passes, the labella being the intake, as we have just seen.

Field-caught *Brachydeutera* may oviposit readily, even when confined in a very small receptacle with water or moist materials. In April 1933, a few eggs were found on dead and partly submerged *kukui* (*Aleurites*) leaves in pools near Honolulu. The eggs (Pl. II, 8) are rather stout, firm-shelled and float well, the blunt, non-micropylar end to the surface. They measure about 0.8 mm. and are mottled brownish. The surface is very finely roughened by what appear to be reticulations which on part of the straighter side are arranged somewhat longitudinally bead-like. The blunted portion towards this side is a thick-margined, pale-dotted subtruncation (Pl. II, 8, upper end; 11). The micropylar end is well rounded, the little button-like micropyle lying in a small shallow depression in the operculum that is marked off externally by an incised line (Pl. II, 10, m; 11, o). The operculum is lifted off through pressure exerted by the larva at the time of hatching. Eggs dissected out of the bodies of several flies numbered from one to more than thirty per fly. In one fly that contained many eggs the majority were soft, pallid and undersized, but about 8 were brownish, firmer and probably fully mature—in fact, one egg enclosed a well developed fly maggot. Well-matured eggs within the uterus have the cap already fully defined. They are extruded from the body, truncated end foremost.

The egg hatches in a day or two, the tail end of the larva sometimes remaining within the shell for a short time. At first the larva is of stubby form and, except for a little of the fore part, has

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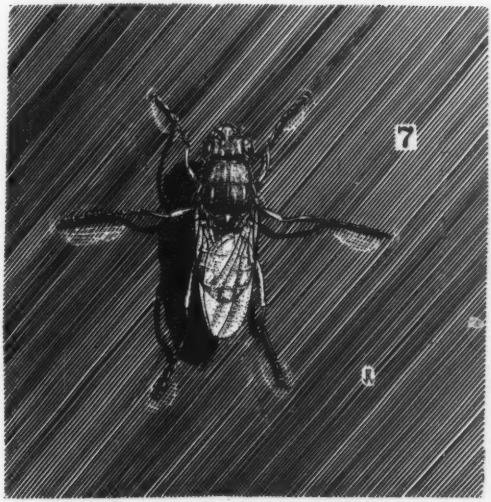
BRACHYDEUTERA HEBES

Explanation of Plate II

7. Adult fly on surface of water. Length to extremity of wings 5-6 mm.
8. Egg floating in water.
9. Hind tarsus, third article, from the side to show hairs in profile so bent that their extremity rests lengthwise upon the surface film of water.
10. Operculum of egg showing micropyle M.
11. Egg in outline to show operculum O (fig. 10) that is being pushed up to liberate the larva.
12. Head of adult, side view; FC, food channel; L, labella; M, maxillary palpus.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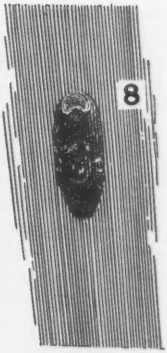
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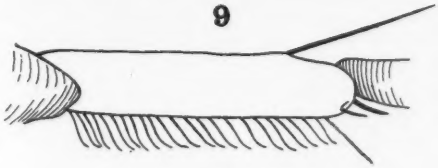
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M
12
FC
L

O
11

a covering of dark hairs, the shorter of these being the more numerous. This vestiture gives it a rather unkempt appearance. Two longitudinal air tubes are visible in the body. These terminate in spiracles mounted on short tubes at the tail end now thrust up through the surface film thereby suspending the larva in the water and permitting it to breathe. At the fore end, the mouth parts are to be seen in motion. Now, the larva brings the head to the surface and swallows a quantity of air visible through the transparent skin as silvery bubbles that accumulate in the alimentary canal and render the insect more buoyant. Sometimes the swallowing of air takes place before the larva is entirely free from the egg shell. In a short while it increases to several times the size of the egg, and, assuming more graceful proportions, is now able to swim with its peculiar precise vertical S-like movement. The head (Pl. III, 15) is small, rather poorly defined, and capable of being withdrawn far into the thorax. It is provided with two simple papilla-like antennae, G, with which it feels about, for it is already a restless and hungry creature that feeds almost incessantly. What might serve as the upper lip bears a sort of mustache, behind which is a dark-colored brush-like apparatus (Pl. III, 14 and 15, (7)); for the lower lip are several rows of short spines with swollen bases (15,(8)). A disc F, seems to represent the maxillary palpi.

Captive specimens nibbled, pecked and particularly scraped the different areas of a dead leaf; they also ate green tissues, tugging with very indifferent success at lateral buds of filamentous algae. A pair of strongly toothed shell-like discs, part of the mandibular sclerites form effective scrapers (13 and 14 (6)). The stomach contents of several large field-caught specimens were examined and, as far as could be determined, consisted mainly of old broken-up plant tissues. In one case there was a nematode worm, and in at least two cases, a clear, crystal-like material. They will swallow the remains of minute ostracod Crustacea. All observations point to a preponderately scavenger habit. The larva (Pl. III, 16) homely and frowsy, feeds most conveniently in water shallow enough to keep its posterior breathing tubes (Pl. III, 16, P. S, and 19) to the surface while it it rummaging about, head under water. Where necessity arises however, it comes up from the depths of a couple of inches or so to take air and then briskly descends below. It swims with far less speed than a mosquito larva, and with vigorous movements that seem quite out of proportion to its rather mild progress. These movements are in a vertical plane, the fore part dives down while the tail end makes a backward stroke, the curved posture suggesting somewhat an S. It can also creep about with caterpillar-like undulations of the body, or it may haul itself along the bottom, using the head part only in its progress. In the larger larvae the transverse folds are

better developed on the underside and these, to some extent, serve as pseudopods or false feet. Not always does it live in open water, however, but may lead quite a secretive existence in the thick growth of filamentous green algae in some pool befouled by the leaves and fruits of guava.

A well-fed *Brachydeutera* larva may attain full growth within ten days; poorly fed and unfavorably placed however, it may develop very slowly and indeed not reach maturity at all. There are three instars. When full grown it is still of rather frowzy appearance chiefly because of the short unkempt dark hairs that clothe it none too thickly. Well forward on the thorax and at the posterior end of the body, these hairs are short and thorn-like. It is now about 10 or more millimeters long, according to the degree of extension. The wrinkled tail end when well extruded calls to mind somewhat the proboscis of an elephant, and the short horns bearing the spiracles are in part hair-fringed at their tips (Pl. III, 19), though not to the extent that we find in many aquatic larvae of more primitive flies. Although the anterior spiracular processes (Pl. III, 20 and 21) are well developed in last instar larvae, never do they seem to be in the least extruded from the invagination pocket in which they lie.

The next stage of development, the puparium, when the skin of the larva hardens, the anterior spiracular processes or respiratory siphons are thrust out, and the pupa is formed, is of great interest. It seems that the larva may wander about a bit, creeping caterpillar-like until it finds a place suitable to transform, for I do not think the transformation occurs commonly in the open water, but along its margin or even above it—at any rate the larva soon becomes sluggish, contracts somewhat, and the tail end particularly becomes upcurved. The fore end can bend and squirm after the posterior portion has stiffened, and the head and mouthparts are still extrusile. On either side of the larval head skeleton within segment 2 of the thorax may be seen a dark rod-like piece[1] that plainly connects behind with a silvered longitudinal air tube. These rods together capable of somewhat pincer-like movement, even when within the thorax, represent the heavily chitinized tips of the respiratory siphons (Pl. III, 20) that are soon to be thrust out. There are still some segmental movements of the thorax. Suddenly, though smoothly, first one then the other siphon is extruded earlike on either side of the glassy, somewhat bilobed head portion. In one case the extrusion of a siphon occupied about 3 seconds. This extrusion seems plainly the result of pressure effected through contraction of the larval skin. These dark-tipped siphons can now be wriggled considerably. At first

[1] In large still active larvae these ensheathed rods are somewhat clublike and studded with pale topped bosses that in the puparium seem to be perforations (Pl. III, 20, S.D.).

they extend parallel pretty well forward but in the end assume the right and left position (Pl. III, 17 and 18) and become rigidly fixed. The puparium becomes, at last, entirely rigid. The dorsum of the thorax is now flattened or even a little concave, and widened as a suboval disc with thickened margins. The body in general retains its furry aspect and is transversely wrinkled (Pl. III, 18). It may be quite buoyant, floating high, back up, or upon its side, being quickly attracted to the sides of a receptacle or nearby object, so that a lot of these puparia thus assembled somewhat suggest a flotilla of small, high-prowed boats. Puparia are also found on top of, or alongside green scum of stagnant little guava-laden pools.

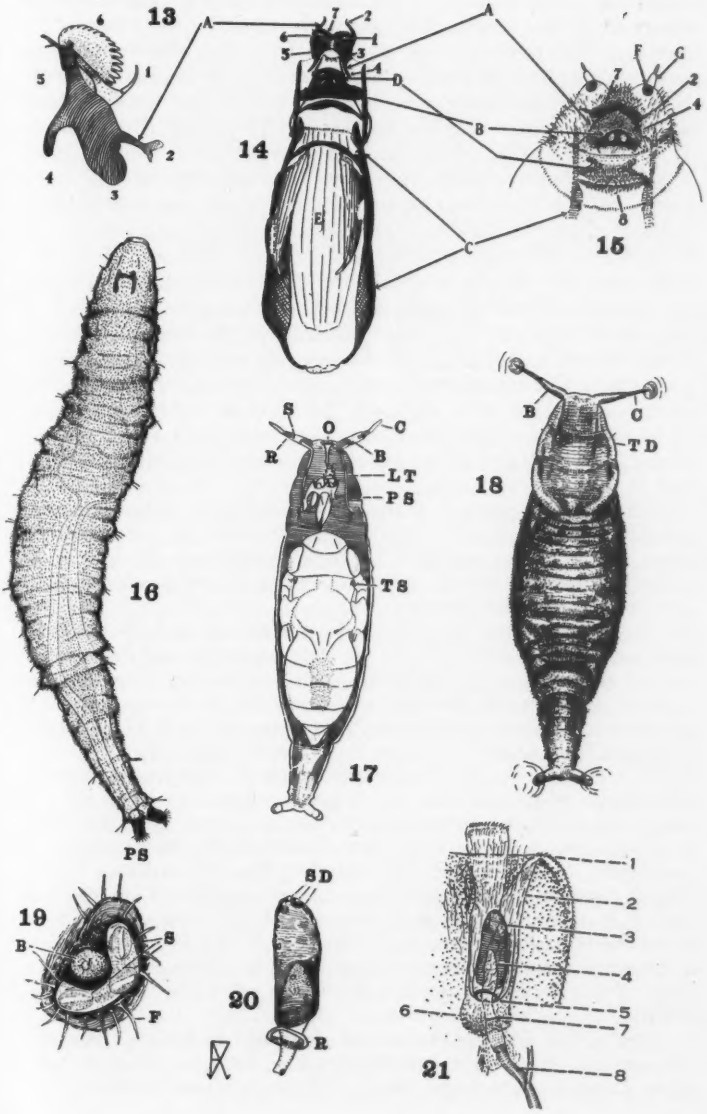
Internal changes continue for some time. Through the integument one sees the larval head-skeleton in movement as it works itself free of the forming pupa to range itself at last along the ventral side of the rigid larval skin, or puparium, seeming to hang from the invagination between the breathing siphons (Pl. III, 17, PS).

If we cut away a portion of the puparium so as to expose the pupa we immediately notice the small size of the pupa as com-

BRACHYDEUTERA HEBES

Explanation of Plate III

13. Mandibular sclerites, one of pair showing semicircular sawlike scraper 6. The numerals correspond to the same parts in figs. 14 and 15. Last instar, side view.
14. Cephalo-pharyngeal skeleton of penultimate instar larva, dorsal view; E, pharyngeal sclerite. The numerals and letters correspond to the same parts in figs. 13 and 15.
15. Larval head, from beneath; last stage; G, antenna; F, maxillary palpus.
16. Larva, last stage, from above; PS, posterior spiracles.
17. Puparium with dorsal wall cut away to show the pupa; the larval cephalo-pharyngeal skeleton PS that hangs from the oral invagination O; C, chitinized respiratory process; R, annulus or ring; B, basal part of respiratory process; S, break in respiratory tube; LT, longitudinal trachea; TS, pupal spiracle.
18. Puparium, dorsal view; B, basal part of respiratory process; C, chitinized respiratory process; TD, thoracic disc which lifts off at the time of hatching of the adult.
19. One of the two posterior spiracular processes, last instar larva, distal view; B, button or scar from previous moult; F, setulae; S, spiracles.
20. Anterior respiratory process dissected from last instar larva to show the numerous very short spiracular digits, SD; R, annulus or ring.
21. Last instar, still active larva to show invaginated respiratory process of thorax exposed by tearing open the body wall; 1, anterior border of segment 2, at edge of pocket or invagination; 2, basal or membranous part of respiratory process which is everted in the puparium (17 and 18, B); 3, the chitinized respiratory process (17 and 18, C); 4, terminus of longitudinal breathing tube showing its apparently non-taenidial character; 5, ring or annulus (17, R); 6, proliferating? cell band; 7, the point in the tracheal tube where the break or separation occurs at extrusion (17, B); 8, longitudinal tracheal tube extending posteriorwards into body.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20
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PS
SD
TD
LT
TS

pared with the length of its container, the puparium. The latter may have a total length of 7-8 millimeters, the pupa scarcely more than half of that length. The new pupa is pale but the eyes darken quickly. The head and tail ends are free from the walls of the puparium, at least in later development, but the intermediate portion quite fills the space along the sides and venter, while dorsally at least for a time, there is a free space. Anteriorly, the puparium is practically all a glistening reservoir of air (or other gas), which explains its great buoyancy. The tracheal tube is interrupted in each respiratory siphon (Pl. III, 17, S), but posteriorly it extends along the flat disc of the thorax and disappears there. On each side of the pupal prothorax above is a large spiracle (T.S.) with part of a silvery tracheal tube visible as leading from it to the interior. These spiracles connect with the air chamber of the puparium. We see then that respiration has been transferred chiefly from the tail end of the larva to the anterior portion in the puparium. The tail end, however, does contain a smaller quantity of air (or other gas) although the tracheal tubes so strongly developed there in the larva seem now broken up and non-functional. A little excreted matter or meconium is present at the tail end of the pupa.

The pupal stage is a matter of a few days. When ready to hatch, the fly pushes up the flattened thoracic disc of the puparium, which hinges up from its base, crawls out and in a short time its wings develop to their proper length and firmness, and it has become a mature insect.

As reared in the laboratory, *Brachydeutera hebes* has a rapid life-cycle. Flies secured March 13, 1932, oviposited almost immediately; some of the eggs hatched March 14; the first puparium was formed during early morning of March 22, while the first adult issued on the morning of March 27; a matter of about 14 days from oviposition to adult fly. Other flies issued March 28 and subsequently. Poorly fed flies in confined quarters, took much longer to transform, or failed to do so. A small experiment indicated that the insect does not pass through dry periods in the puparium. Several dozen puparia collected in their natural environment yielded no parasites. A Californian ephydrid fly (*Ephydra millbrae* Jones) that is common in salt water ponds along a portion of the shore of San Francisco Bay is parasitized by chalcidid wasps which issue from the puparia, (Jones, B. J. Catalogue of the Ephydridae, with Bibliography and Description of new species. University of Calif. Publ. Tech. Bull. Entom., Vol. I, No. 2, pp. 152-198, illustrated, 1906).

The genus *Brachydeutera* was described in 1862 (Loew, H., Monograph North American Diptera I. p. 162) to receive *B. dimidiata* Loew (= *argentata* (Walker)), a species widely distributed

in temperate and tropical America and in Europe. The Hawaiian species was for a time confused with *B. argentata.*

Regarding the habits of *B. argentata,* which is a little śmaller than our *hebes,* Dr. L. O. Howard, writes in part as follows (Insect Book, p. 182, 1901): "I have reared *Brachydeutera argentata* . . . from larvae found in a small pool which was strongly impregnated with horse manure from an adjoining manure heap." O. A. Johannsen (Mem. 177. Cornell U. Agric. Exp. Sta. Aquatic Diptera, Part II, 1935) gives a good account with illustrations of *Brachydeutera hebes.*

This genus is represented by a very few species and occurs in the north temperate regions and in the tropics of both hemispheres.

Scatella (Plates IV, V, VI)

These are small compact dusky flies the wings of which are usually spotted with whitish. They are found as a rule in considerable numbers at the margins of brackish pools, of reservoirs, ditches, flumes, on wet boulders along streams, moist to dripping wet banks, etc.; much according to species. What is of interest therefore in the genus is the more or less well-defined habitat of its several species and also their obvious suitability, in some cases at least, in their early stages to their environment. These flies are of a generally rather sluggish disposition; in striking contrast for example, to the restless dolichopodid flies so often found in similar situations. They are fair flyers and if perchance driven upon open water will quickly make their way ashore in hopping flight, not being willing performers upon the surface film. The males are often seen courting the females. One will face her and moving from side to side thus describe little arcs; very frequently he gets immediately behind her, raises and lowers his wings and then mates with her.

The eggs are deposited on wet materials or they may be shallowly submerged. They are whitish, measure from about half to a little more than half a millimeter in length, with a finely reticulate pattern more or less evident. From the apex of the narrower end and extending towards the less curved side is a slightly depressed truncated area that may be strongly margined in horseshoe form (Pl. IV, 28; Pl. VI, 38). When hatching time is near at hand the larva may be seen through the shell as a tightly fitting duskily segmented creature of undulatory movements. Its forked tail is jammed against the broader end while the blackish cephalo-pharyngeal skeleton shows clearly forward. Soon the well-toothed paired dental process—the anterior hinged part of this skeleton—is observed in downward strokes as it scratches the shell just beneath the obliquely truncated area so that eventually with the aid of pressure a rent is made through which the larva issues (Pl. VI, 39). The larva is covered with spinules, better developed in some species than in others. After the first moult a digitate respiratory organ appears

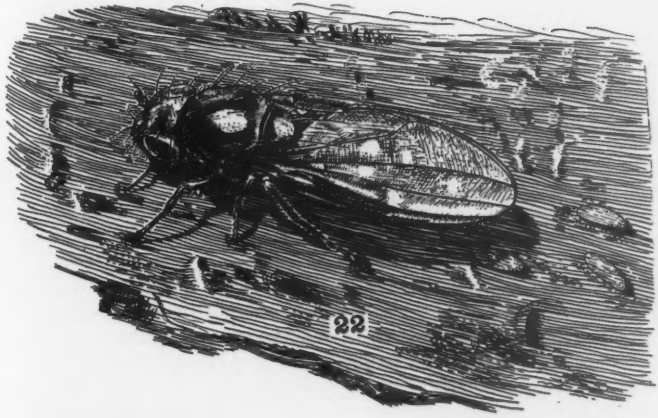
on each side of the thorax (Pl. VI, 40). Each arm of the forked posterior terminates in a cap provided with spiracles and palmate hairs, or hooks (Pl. VI, 41, 42 and 37; Pl. V, 32A). Segmental abdominal swellings serve in a measure as pseudopods, for the larvae are creepers along wet and often algal-covered margins, in thinly water-sheeted banks, etc. They feed by an almost incessant down-scraping movement of the head end. They are comparatively helpless in deep water but, as observed in *Scatella bryani* Cress. rendered buoyant by swallowings of air, they may be able to progress slowly by withdrawing head and tail beneath the surface film and then by rather slight bendings of the body, roll over and over somewhat barrel-like. There are, I believe, three larval stages. The puparia are naturally found in about the same situation as the eggs and larvae. They are often more or less distorted (Pl. V, 34) and rest dorsal side uppermost (Pl. V, 30). The adult hatches by forcing up hinge-like the flattened disc of the thorax. Both larvae and puparia as far as known, offer specific characters.

At, or very near the seashore we find *Scatella terryi* Cresson and *Scatella sexnotata* Cresson (Proc. Haw'n. Entom. Soc., VI, pp. 275-6, 1926). *S. terryi* is of a general brownish-olive opaque color, the wings five-spotted and the mesonotal setulae not well developed. The type is from Wawamalu Beach, near Koko Crater, Oahu (E. H. Bryan, Jr.). Others have been found on tide rocks at Waianae, Oahu. The writer knows nothing of its early stages. *S. sexnotata* (Pl. IV, 23), 3-3.5 millimeters long of opaque appearance, wings six-spotted and the notal and fore-femoral bristles well developed, is an abundant and widespread maritime species in the Hawaiian Islands. It favors stagnant saline pools—such as are formed by particularly high tides—marshes, and mudflats that often glisten with salt crystals. In these areas frequently encompassed by such succulent plants as *Batis maritima* Linn. (Batidaceae) or *Herpestis monniera* H. B. K. (Scrophulariaceae) its most obvious insect associates are likely to be the water-boatman bug *Trichocorixa blackburni* (White), the large dolichopodid fly *Hydrophorus pacificus* V.D. and a little borborid fly of the genus *Leptocera.* This *Scatella* also occurs on tidal flats, wet beach sand and tide rocks and has been

SCATELLA

Explanation of Plate IV

22. *Scatella oahuense,* resting on a boulder over which a very thin sheet of water is flowing. To its rear may be seen three eggs. From head to extremity of the wings the fly measures 4.05 mm. Honolulu.
23. *Scatella sexnotata,* wing. Mud flats, Waialua, Oahu.
24. *Scatella oahuense,* wing. Honolulu.
25. *Scatella bryani,* wing. Green Lake, Kapoho, Hawaii.
26. *Scatella hawaiiensis,* wing. Honolulu.
27. *Scatella warreni,* wing. Lulumahu stream, near Honolulu.
28. *Scatella bryani,* egg. Length 0.48 mm.



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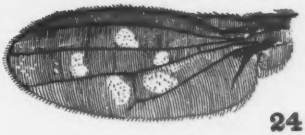

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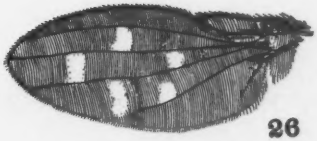

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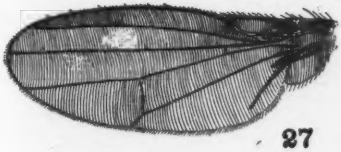

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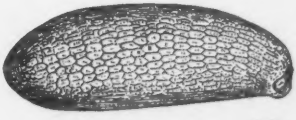

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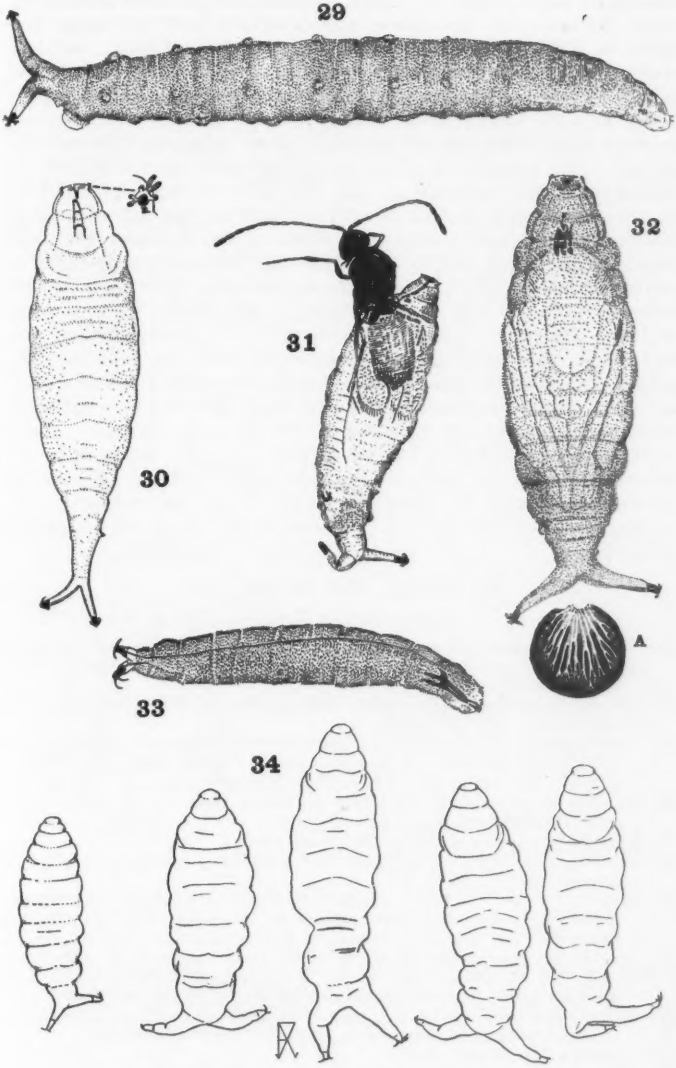
observed at reservoirs near the sea that more properly belong to the domain of *Scatella bryani* Cresson (1926), which, however, may in turn invade saline flats. The eggs are about 0.65 mm. long and rather well sculptured. The larvae bear four fans or palmate hairs on each caudal process, throughout their existence. The puparia seem usually to have the tail end well curved upwards. *Scatella bryani* is our smallest species. It is about 2 mm. long and has six well-marked wing spots (Pl. IV, 25), a seventh spot being more or less apparent in this (and other) species basally in the costal cell. It is found in many lowland situations usually where there is standing water—lakes, lily ponds, reservoirs, overflow areas, stagnant ditch and sewer water, gutters, etc. The egg is about 0.48 mm. long, well reticulate and rather stout (Pl. IV, 28). The larvae have caudal palmate hairs as in *sexnotata*. This species is particularly easy to rear in moist decaying algae such as are accumulated along the margin of reservoirs. What appears to be a dusky form of *S. bryani* was taken at an altitude of between 5000 and 6000 ft. at small exposed water pocket in a limb of an *Acacia koa* Gray (*Leguminosae*) tree on Mauna Kea, Hawaii. The type of *S. bryani* was described from Awaawapuhi, Kauai (E. H. Bryan, Jr.)

Now, if we leave the open lowlands of Oahu and explore its valleys and canyons where the water runs clear between boulders, as a thin sheet over a slope, or merely oozes from some trailside bank, at least three additional species of *Scatella* will be found, for much additional study is needed on this more upland assemblage. Two of these species, *S. hawaiiensis* Grims (1901) and *S. oahuense* n. sp. often occur intermingled. The third, *S. warreni* Cresson (1926) may also be in company with one or possibly both of the two others, and frequently with the canacid fly *Procanace nigroviridis* Cresson, of rather similar habits. *S. hawaiiensis* (Pl. IV, 26; Pl. V, 35) differs from *S. oahuense* (Pl. IV, 24; Pl. V, 36) chiefly in its much larger postvertical bristles, better defined wing spots and more sinuous veins. From a standpoint of habitat I have been unable thus far to separate *S. hawaiiensis* from *S. oahuense*, and indeed, up to the present time they seem not to have been recognized as two species.

SCATELLA

Explanation of Plate V

29. *Scatella hawaiiensis*, or *oahuense*, last larval stage.
30. *Scatella bryani*, puparium, dorsal view. Length 3.9 mm.
31. Figitid wasp that has died in issuing from the puparium of *Scatella hawaiiensis*, or *oahuense*. Puparium about 3 mm. long.
32. *Scatella hawaiiensis*, or *oahuense*, puparium. Length 4.1 mm. At A is shown, more enlarged, one of the four palmate hairs of the caudal spiracular processes of a *Scatella* larva.
33. *Scatella oahuense*, first stage larva.
34. *Scatella warreni*, puparia. All are to same scale. Secured among algae and diatoms along the margin of a swift-water cement ditch, Waianae, Oahu.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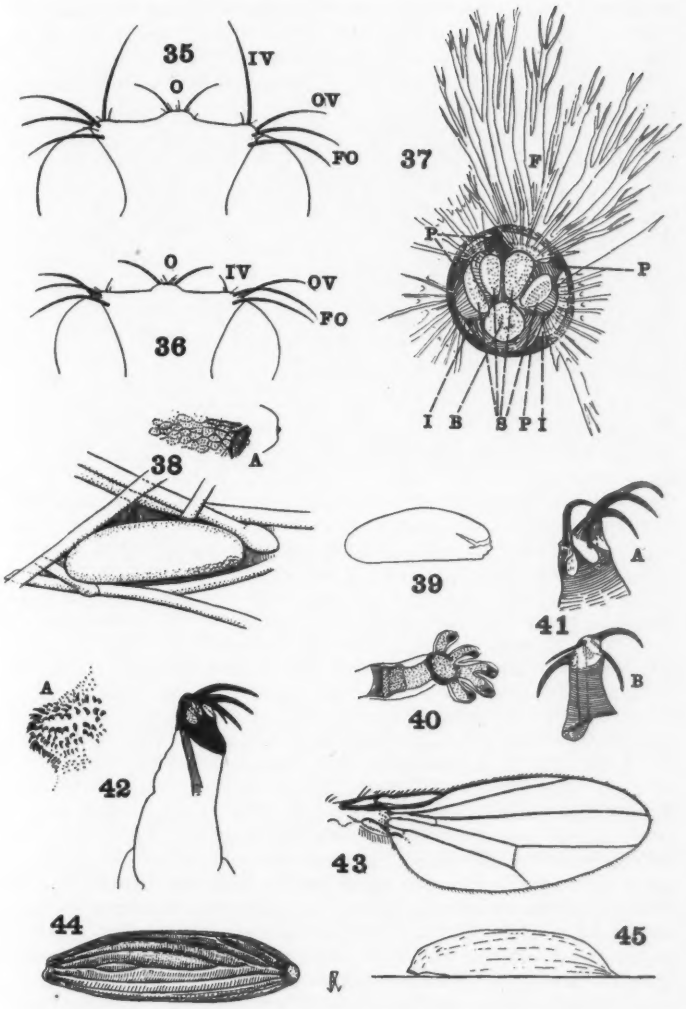
Both are well distributed on Oahu. *S. oahuense* has also been taken on Hawaii at an altitude of about 5200 ft. and on Haleakala, Maui, above 8,000 ft. *S. hawaiiensis* was described from specimens collected at 2000 ft. on Mt. Kaala, Waianae Mts., Oahu. The two species may be very conveniently found at moderate elevations behind Honolulu. Here one, or perhaps both may be seen, where the water as a mere sheet flows over a boulder, clinging in midstream to some tiny barely submerged bit of moss, algal or diatomaceous growth. And here also in this very shallow water may sometimes be found the delicate white eggs (Pl. IV, 22). A thriving colony of *S. hawaiiensis* was located at an oozy leak on the side of a large wooden water tank on the lower slopes of the Waianae Mts. All stages were represented in the green and brown scummy material nurtured by this leak. In addition, a plain gray *Psychoda* fly was breeding here. The *S. hawaiiensis* eggs were rather stout of form and well sculptured as in *S. bryani*. Like *S. sexnotata* and *bryani* this species from the beginning is provided with four palmate hairs surmounting each caudal spiracle-bearing process. The larva of *S. oahuense* on the other hand in the first instar has four curved thorns surmounting these two processes. One of these thorns is much weaker than the others (Pl. VI, 41B). They are replaced in the following instar by regulation palmate hairs. Fig. 32A shows the structure of one of these hairs, while fig. 37 gives a bird's-eye view of the spiracles, etc., at the extremity of one of these caudal processes.

SCATELLA AND HYDRELLIA

Explanation of Plate VI

35. *Scatella hawaiiensis,* female, upper front portion of head to show principal bristles; O, ocellar; I. V., inner vertical; O. V., outer vertical; F. O., fronto-orbitals.
36. *Scatella oahuense,* female; upper front portion of head; lettering as in fig. 35.
37. *Scatella,* larva; apex of one of the paired caudal processes to show spiracular disc; S., spiracles; B, button or moult scar; P, pillars; F, fan-like palmate hair arising from interval or membranous area, I.
38. *Scatella hawaiiensis,* or *oahuense;* egg among algae; A, showing micropyle and sculpture. Egg length 0.55 mm.
39. *Scatella hawaiiensis,* or *oahuense;* hatched egg.
40. *Scatella hawaiiensis,* or *oahuense,* last stage larva; thoracic respiratory process.
41. *Scatella warreni* (A) and *Scatella oahuense* (B); first stage larvae; extremity of one of the two respiratory processes. The spiracles are situated at the base of the hooks in the membranous area. In A, the hooks are present throughout the larval instars—and in the puparium; in B they are present only in the first larval instar, being replaced at the first moult by regulation palmate hairs. Drawn to same scale.
42. *Scatella warreni;* one of the pair of caudal larval processes, showing strongly developed hooks. At A, is one of the larval pseudopods.
43. *Hydrellia hawaiiensis,* wing.
44. *Hydrellia hawaiiensis,* egg, from above. Length 0.53 mm.
45. *Hydrellia hawaiiensis,* egg from side.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Probably the most water-loving of our *Scatella* is *S. warreni* Cresson (1926). It favors swift flume and ditch waters, rushing streams, waterfalls and the cool water-sheeted banks of uplands. It has rather long dusky wings with indications of one or more pale spots. It varies much in size and, as the smallest forms are often associated, there may be really more than one form involved. In the same environment one finds the sooty canacid fly with green and gold eyes as well as the erratic *Telmatogeton* midge that in its wild coursing over dripping boulder and wave-washed flume margin not infrequently collides with these staid little water-lapping flies. *S. warreni* was found particularly abundant and in almost pure colonies along the Kalihi Valley stream, Honolulu. Here also, barely submerged were seen its delicate white eggs. The larva is more strongly setulose particularly as regards the pseudopods than are the other species we have considered (Pl. VI, 42A). Furthermore, the paired caudal processes are provided in all the instars with four grapple-like hooks (Pl. VI, 41,A; 42). These hooks curve ventrally and together with the backwards-pointing thorns on the pseudopods make for a secure anchorage in the algal and other growth in the often strong wash or current of its environment. This fly then, and some others are quite at home along ditches and flumes. A cement-lined ditch passing into an iron flume, in the heated Waianae lowlands, carries clear swift-flowing water from the steep slopes of Mt. Kaala almost overshadowing it, to the sugar cane fields. And from these cool forested slopes have descended several of the water-frequenting insects. *Scatella warreni* and *Procanace nigroviridis* are both present busily lapping up moisture, and the puparia, often of rheumatic aspect (Pl. V, 34), of the former are likely to be found, sometimes more or less imbedded in the water-washed margin of scummy growth. *Dasyhelea hawaiiensis* Macfie, a tiny ceratopogonid midge is also here, but most obvious is the active *Telmatogeton abnormis* (Terry), its dark olive green larva being a lover of highly oxygenated water. A psychodid fly breeds along the flume margin and *Scatella bryani* present aside in a tiny leak puddle passes its early stages also in the upper portion of this marginal band of algae. On the Island of Hawaii V-shaped or square wooden flumes carry water from the uplands. The current often attains great velocity and small waves wash the margins. Here also is *Scatella warreni* placidly sitting alongside the rushing water. *Telmatogeton torrenticola* (Terry) much larger than the Oahuan species races along the water's edge, now and then to be caught in the current and borne downstream but soon gaining shore, persists in its advance. Others rest quietly in small groups and here and there a female is laying her cluster of eggs. The adaptable crane fly *Limonia grimshawi* Alexander breeds in the algae a little above the water line. Well up in the mountains behind Honolulu I have observed *Scatella warreni* freshly issued from the puparium, its wings still

wrinkled and stubby, floating down from a little rapids into a shallow pool and thence at last to shore. On the surface of this pool a number of dusky *Campsicnemus miritibialis* V. D. (Dolichopodidae) flies were skating with great rapidity, on the lookout for prey which in this case appeared to be mainly the little green *Tanytarsus* midge, itself freshly hatched and afloat. W. A. Warren (Proc. Haw'n. Entom. So. III, 25, 1913) published some interesting notes on *S. warreni*. He observed freshly issued flies floating in a flume in Honolulu and, upon further investigation, found larvae and pupae in the masses of algae. These early stages he describes briefly.

Flies of the genus *Scatella* have a number of enemies. Among these are the nymphs of certain of our damselflies (*Megalagrion*) that frequent dripping wet banks and boulders. These may devour both adult and young *Scatella*. Quite frequently the puparia have a large perforation, the emergence hole of a figitid wasp, examples of which are often seen exploring in their tedious manner the moist habitations of *Scatella* larvae, into which they thrust their ovipositors. Figure 31 shows one of these wasps that failed to completely issue from a puparium of *S. hawaiiensis* or *oahuense*. Figitids are also to be seen about the briny mud of maritime swamps, home of *Scatella sexnotata*. The Figitidae are fairly numerous in the Hawaiian Islands. Some are well known as parasites in dipterous puparia. Their classification is in a rather unsatisfactory state.

Scatella oahuense n. sp. (Fig. 24, wing; 36, dorsal bristles of head; 33, larva, first instar; 41 B, caudal hooks first stage larva.)

Female, holotype—Head and thorax shining black above, becoming somewhat brownish pollinose at side and below; abdomen also brownish dusted. Wings infuscate, with five whitish spots only moderately distinct; veins only slightly undulating at these spots. Inner vertical bristles weak; mesonotal setulae sparse; three well developed dorso-centrals and one strong pair of acrosticals. Fore femora with a few moderately strong post-flexor bristles. Length 2.8 mm.

Male, allotype—Like the female.

Resembles *S. hawaiiensis* Grimshaw, from which it differs chiefly in its quite small inner vertical bristles. The wing spots are less distinct and the veins scarcely undulating at these spots.

Type: Female; Hering Valley, Tantalus, Honolulu, March 6, 1937. Wet bank (F. X. Williams).

Allotype: Male; Pauoa Side of Tantalus, Honolulu, February 25, 1937. Wet bank (F. X. Williams).

Paratypes: 12 females and 6 males. Tantalus, Upper Manoa Valley, Honolulu, Waikane, Kaluanui Valley, and Mt. Kaala, Oahu, 1936 and 1937. (F. X. Williams).

Holotype and allotype in collection of Hawaiian Entomological Society; two male and two female paratypes deposited in B. P. Bishop Museum.

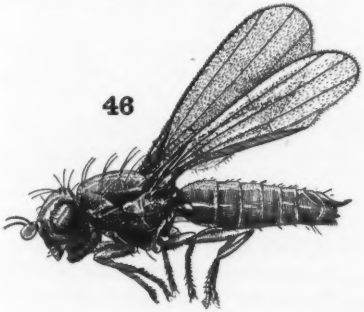
An abundant species. Occurs also on Maui and Hawaii.

Canace nudata Cresson. (Plate VII, 47, 51, 52).
Cresson, E. T. Jr., Trans. Amer. Entom. Soc., 52, pp. 257-258, 1926. (California).

This is the quiet dusky little fly that under favorable conditions literally swarms on the tidal rocks of our sea-coasts. Engaged in the customary ephydrid habit of lapping up moisture, for dear life it would seem, it is nevertheless fully alert to the oncoming wave that it evades by a quick upward flight and forthwith settles again upon the dripping rock. *Canace* then is one of several species of Diptera that help animate this narrow belt of land and sea. Quite likely to be the most conspicuous of these other flies is the dolichopodid *Cymatopus acrosticalis* Parent (1937), almost constantly on the move as it forages for some larva or other delicate organism made available by receding waters. On occasion, certain midges of the genera *Clunio* and *Telmatogeton* may draw attention by reason of their great activity. And finally in the upper tidal zone and beyond, a tiny *Dasyhelea* midge may be seen singly or in little swarms. *Canace* is not always at the edge of the surf but occurs also about certain pools more or less out of reach of ordinary tides. One such at Hanauma Bay near Honolulu, was very shallow and rested upon a thin layer of volcanic mud in places more or less bound together felt-like by algae etc. and that curled or flaked up where exposed to air. The whitish eggs (Pl. VII, 47) which *Canace* was induced to lay on some of this material showed a very fine reticulate structure, and a slightly granulate protuberance at the narrower end. They measured about 0.4 mm. long. Sometimes one finds a *Canace* larva more or less imbedded in some of this wet felt-like material. It is active but quite unable to swim. A large specimen may be 5 mm. long. It is covered with fine spicules with a rather sparse assortment of stout erect spines of considerable size on the back, which bears also fine very close granulations appearing almost plate-like. A grouping of tiny plates rather than granulations is present on the fore part of the thorax above. The anterior respiratory processes are very well developed. Posteriorly the paired longitudinal tracheae terminate separately as approximate spiracles in a single tube-like extension of the body (Pl. VII, 52). The underside of the *Canace* larva is relatively unarmed save for the extrusive anal proleg that is provided with a number of strong anteriorly-curved

Explanation of Plate VII

46. *Procanace nigroviridis*, female.
47. *Canace nudata*, eggs. Length 0.41 mm.
48. *Procanace nigroviridis*, puparium, ventral view. Length, 2.3 mm. At A, is the thoracic respiratory organ of the larva.
49. *Procanace nigroviridis*, wing.
50. *Procanace nigroviridis*, labella terminating the proboscis, from the side.
51. *Canace nudata*, puparium, from the side.
52. *Canace nudata*, larva, from the side.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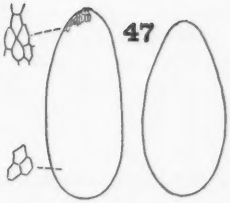
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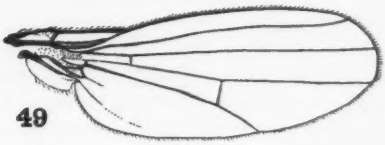
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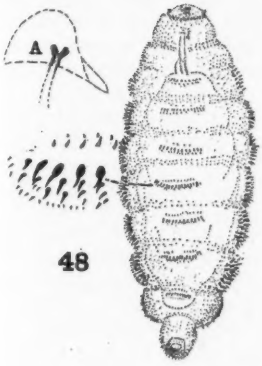
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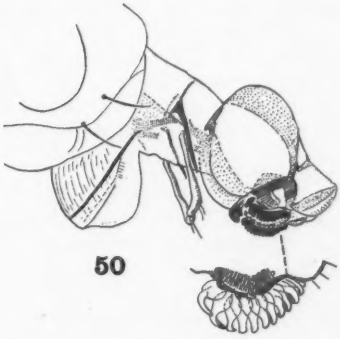
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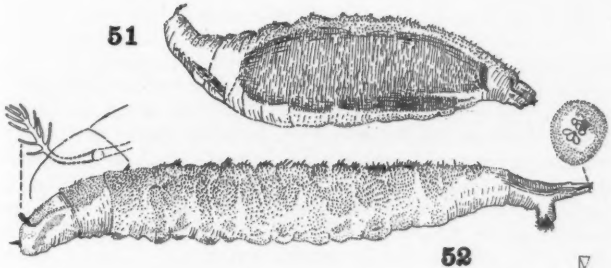
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hooks that indicate good powers of anchorage. The puparium (Pl. VII, 51) is stout and rather curved at each extremity, with the larval respiratory processes somewhat reduced. It also may be more or less imbedded in the wet substratum. The larva is saprophytic or perhaps a feeder on living algae as the sometimes green matter in its intestines suggests.

Canace nudata is not peculiar to the Hawaiian Islands since it occurs on the Pacific Coast of North America, and extends at least as far as Wake Island, 19° 15′ N, 166° 30′ E, towards the coast of Asia.

Procanace nigroviridis Cresson. (Plate VII, 46, 48, 49, 50).

Cresson, E. T. Jr., Proc. Haw'n Entom. Soc., VI, pp. 277-278, 1926. (Described from Awaawapuhi, Kauai 1922, E. H. Bryan Jr.—Collector.

This fresh-water species superficially resembles *Canace nudata* of the sea-shore. It measures from about 2.5 to 3 mm. long and its somber coloration is relieved somewhat by the golden green eyes and a greenish shade on the front and top of the head. It is partial to canyon and mountain streams and to swift-water flumes, being often in company with *Scatella warreni* and to a less extent with the spotted wing species. It probably occurs on all the major islands but thus far seems to have been collected only from Kauai, Molokai and Oahu. On Molokai and Oahu it has been taken on wet stream boulders up to an altitude of about 2000 ft. Its habits are much like those of *Canace* and of *Scatella*. Courting scenes are about similar —the male very alert, wings outspread like a soaring bird faces his prospective mate that with apparent unconcern may be lapping up moisture or slowly moving forward; he makes little sudden moves, lowers his wings slightly or suddenly follows close behind her; to be accepted or rejected. Eggs as dissected from the body of the fly greatly resemble those of *Canace nudata*. They measured about 0.4 mm. long, with a low blunt apical process and a finely reticulate pattern. The larva which was but rarely taken, lives among scum, algal and other fine growth on wet rocks etc., as with its *Scatella* associates. It is a curious broad fusiform rather ventrally flattened creature, covered with very short dark spicules except on the underside. In addition to this armament, most of the abdominal segments bear on the lower part of their side a number of stout erect slightly curved spines, while across the middle of the underside are seven segmental bands of generally backward-pointing spines. Finally, an anal pseudopod is provided with strong procurved spines much as in *Canace*. The two respiratory processes of the thorax are bifurcate while a single retractile anal tubular process forms the terminus of the paired longitudinal tracheae ending in spiracles. The larva is sluggish and seems unable to swim. The puparium (48) much resembles a short stout larva. Both appear well suited for anchorage among low growth, etc. in running water.

FAMILY ANTHOMYIIDAE

This family is well represented in the Hawaiian Islands where it reaches its greatest development in the genus *Lispocephala* with 38 described species and many more sure to be discovered. Some of these are of considerable size. They are most abundant in the moist upland forests. Some have the habit of perching on the downbent end-portion or the underside of the leaves of shrubs—and also, to quote Dr. R. C. L. Perkins (Fauna Hawaiiensis, Introduction, p. clxxxvii, 1913) in referring to these flies under the name *Coenosia:* "The larger ones may sometimes be seen in some numbers on the trunks of trees, having a bold appearance, as they stand ready to dart off after some other insect". Perkins and others have found species of this genus stored in the nests of our fly-catching crabronid wasps. The damp-woods species probably breed among wet debris and mud, in decaying plant tissues (banana stems, etc.) and perhaps at the leaf bases of certain plants. Those *Lispocephala* that patronize wet boulders along streams, or dripping mossy banks are in some cases at least, semi-aquatic. Our common *Lispa metatarsalis* Thom. is chiefly a lowland insect frequenting reservoirs, ditches, mud flats, etc. A number of exotic genera of anthomyiids frequent water. Of considerable interest are certain forms referred to by Tillyard on page 374 in his Insects of Australia and New Zealand, 1926, as follows: "A striking group of genera are the predatory flies, called 'cannibal flies' in New Zealand, which are found resting on rocks in or near running streams, and which fly up and seize other insects (especially Mayflies) and suck them dry; these belong to the genus *Trichopthicus,* and are also found in Tasmania."

Some of the Anthomyiidae are decidedly beneficial insects. Thus P. Tate (Parasitology, XXVII, pp. 556-560, 8 figs., 1935) found the larva of *Phaonia mirabilis* Ringdahl preying upon mosquito larvae at Cambridge, England. The very active *Phaonia* larvae were able to rapidly encircle their prey. Records of the predacious habits of adult Anthomyiidae are numerous. A good summary and list of references of these is given by B. M. Hobby (Entom. Mo. Mag., LXX, pp. 185-190, 2 figs., 1934) who also figures the mouth-parts of several species to show adaptation for the capture of prey. Of considerable interest here is the account by W. A. Lamborn (Bull. Entom. Res., XI, pp. 279-281, 1920) of "The habits of a dipteron predaceous on Mosquitos in Nyasaland." The fly involved, a species of *Lispa,* grasped larvae, pupae and emerging adults and also crippled adults, from the surface of the water.

Previous records of *Lispa* preying on mosquito larvae are those by J. Mitford Atkinson (Jl. Trop. Med., XII, 1909, pp. 255-6) and by Howard, Dyar & Knab (Mosquitos of N. America, I, 1912, p. 170).

Lispa metatarsalis Thomson. (Plate VIII).

Thomson, C. G.: Voyage de "l'Eugenie", Insects, p. 562, 1868.

Stationed alertly upon masses of green algae that blanket-like overlie portions of lowland reservoirs and are accumulated along their banks, found likewise on muddy shores of marshes, sometimes saline, more rarely extending its range to sluggish portions of small mountain streams, and more rarely still to highland ridges, *Lispa metatarsalis,* a pale gray-brown carnivorous fly of ordinary appearance and solitary habits claims a place among our semi-aquatic insects. In size it is somewhat less than our common housefly, but its markings are more obscure and moreover it has the habit of keeping its wings one quite overlapping the other over the back. It is a strong flyer and, being usually on the lookout for something to eat, may often be seen walking in a brisk, aggressive manner towards some small insect that has attracted its attention. Thus the tiny moth fly, *Psychoda alternata* Say falls a prey to *Lispa,* and I have also seen it capture with the help of its fore paws the little phyllomyzid fly, *Milichiella lacteipennis* Loew on the window pane of a veranda. A favorite resort of these insects at Waianae, Oahu, was along the vertical sides of a cement ditch set to the level of the ground and containing at the time—April 1936—about a half inch of gently flowing or standing water well margined and layered with the bright green algae, of which a ribbon-like *Enteromorpha* sp. was the most conspicuous. Here *Chironomus hawaiiensis* Grims. was breeding in some numbers, with *Psychoda* and two Ephydridae, *Scatella bryani* Cress. and *Hydrellia hawaiiensis* Cress. also common. *Lispa metatarsalis* was likewise numerous on rockwork bordering a neighboring reservoir, newly filled, and teeming with *Chironomus* and tiny Crustacea. *Lispa* does not seem to rest or travel upon water. When confined in a tube supplied with some mud or algae this ravenous insect would sometimes quite readily deposit

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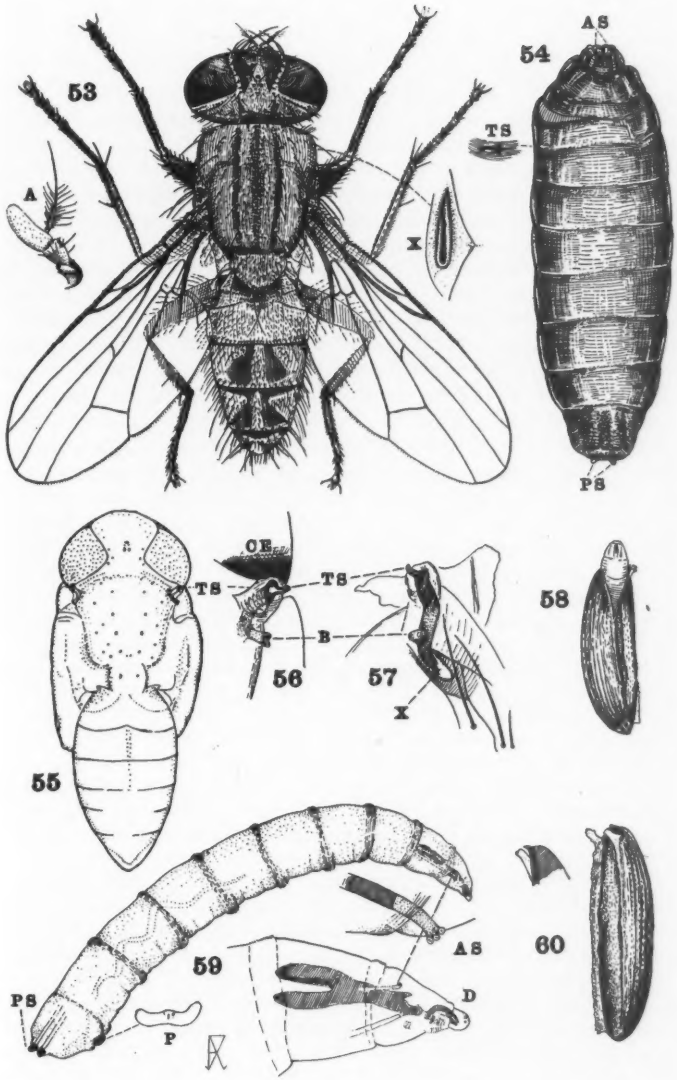
LISPA METATARSALIS

Explanation of Plate VIII

53. Adult fly, male. Length 6 mm. The wings are naturally held one overlapping the other over the back. A, antenna; X, prothoracic spiracle.
54. Empty puparium. Length 5.8 mm. AS, tiny buttons indicating prothoracic spiracles of larva; TS, prothoracic spiracle of pupa that is exserted through the 4th segment of the puparium; PS, posterior spiracles.
55. Pupa, dorsal view. TS, prothoracic spiracle.
56. Spiracle of fig. 55 more enlarged. B, supplementary spiracle; CE, compound eye.
57. Spiracle of fig. 56 more or less dissected out to show the somewhat imbedded prothoracic spiracle, X, of the adult. See also X, fig. 53.
58. Egg with the larva hatching from slit at upper end.
59. Larva about two-thirds grown, dorso-lateral view. Length 8 mm. AS, anterior spiracles; D, side view of anterior portion to show head skeleton; P, anal plate; PS, posterior spiracles.
60. Egg, with flap end in lateral profile. Length about 1.5 mm.

Proc. Haw. Ent. Soc., Vol. X, No. 1 Plate VIII



its rather curiously shaped, seed-like, dull olive brown eggs. These measure about a millimeter and a half in length and, except for a wide gently rounded, well flanged area, are longitudinally ridged. Some eggs that I had placed in water hatched within 24 hours, the larva issuing from a slit formed at the flap-bearing end of the shell (Pl. VIII, 58). This freshly hatched larva seems incapable of swimming; it is, however, provided with a longitudinal tracheal system—already well silvered—extending from the tiny anterior stigmata to the larger caudal pair. Low prolegs are already present.

The larvae were kept in a small dish partly filled with water containing also a mass of filamentous green algae. Although capable of remaining completely submerged for a considerable period, they stayed habitually close to the surface, caudal spiracles exposed to the air. At large, *Lispa* larvae were found in masses of algae bordering small, more or less stagnant pools, under wet shore debris, etc., to altitudes of about 1000 feet. They occurred also among debris and decaying organic matter accumulated at the leaf bases of the ieie vine (*Freycinetia arborea* Gaud., Pandanaceae)—as noted near the summit of Awawaloa, Koolau Mts., at an elevation of about 2400 feet. No doubt they devour various larvae particularly those of nematocerous flies, and readily fed upon "bloodworms" (*Chironomus*) that so frequently share the same environment. As the *Lispa* larva grows it assumes a distinctly yellowish color and finally attains a length of 10 mm. or more, presenting a tapering fore end and a thick club-like posterior one, whence the short hair-fringed stigmata protrude. The mouth hooks (Pl. VIII, 59D) are simple and slender, the anterior spiracular processes (Pl. VIII, 59, AS) are 3-lobed, quite small and protrude obliquely forward from the posterior part of the first thoracic segment. Fine parallel spinulate ridges girdle the anterior part of segments 2-9, the development being generally less on the sides. Such transverse ridges are also present on the fore part of segment 1, while ventrally on 5-9 they are well developed on the paired swellings or pseudopods. On segment 10 there is a well developed mid-ventral pad, immediately behind which is the chitinized anal plate (Pl. VIII, 59, P). In a reared specimen the larval stage occupied about two weeks.

The formation of the puparium (Pl. VIII, 54) and within it later, of the pupa (Pl. VIII, 55), are of considerable interest. The puparium is really a pupal case and is the contracted, hardened and darkened skin of the larva, larval structures remaining more or less visible. The anterior 3-digitate larval spiracles for example—soon to lose their respiratory connection—become reduced and probably non-functional with their replacement in the pupa by a pair of conical spiracular processes (Pl. VIII, 54-57, TS) pushing through dorso-laterally on segment 4 of the puparium. The point at which

these processes are to be thrust out up to their broadening base is indicated by a small pale spot. This spiracular extrusion did not take place—as observed—for more than 24 hours after the puparium had been formed. These little processes show a number of tiny oval slightly convex transparent dots, probably air pores, and clearly connect with the tracheal system of the pupa now formed. Posterior to them but arising from the same tube is a far less chitinized short bifurcate process (Pl. VIII, 56 and 57, B) each arm of which bears a considerable number of very short pale fingers. This process seems not quite to reach the surface of the pupa. It appears likewise to be respiratory in character. The pupa fits rather snugly within the puparium. It matures in a few days, the fly emerging by pushing apart by means of its temporarily swollen forehead a portion of the anterior end of the puparium. The provisional prothoracic spiracular apparatus (TS and B) of the pupa is shed off the longitudinal trachea at the point where the large prothoracic spiracle (Pl. VIII, 53 and 57, X) of the adult is formed.

This fly has been taken on the Islands of Oahu, Molokai and Hawaii. It probably has a much wider distribution in the archipelago.

Lispocephala fusca Malloch. (Plate IX)

Malloch, J. R., Proc. Haw'n. Entom. Soc., VII, No. 1, p. 85, 1928 (male and female).

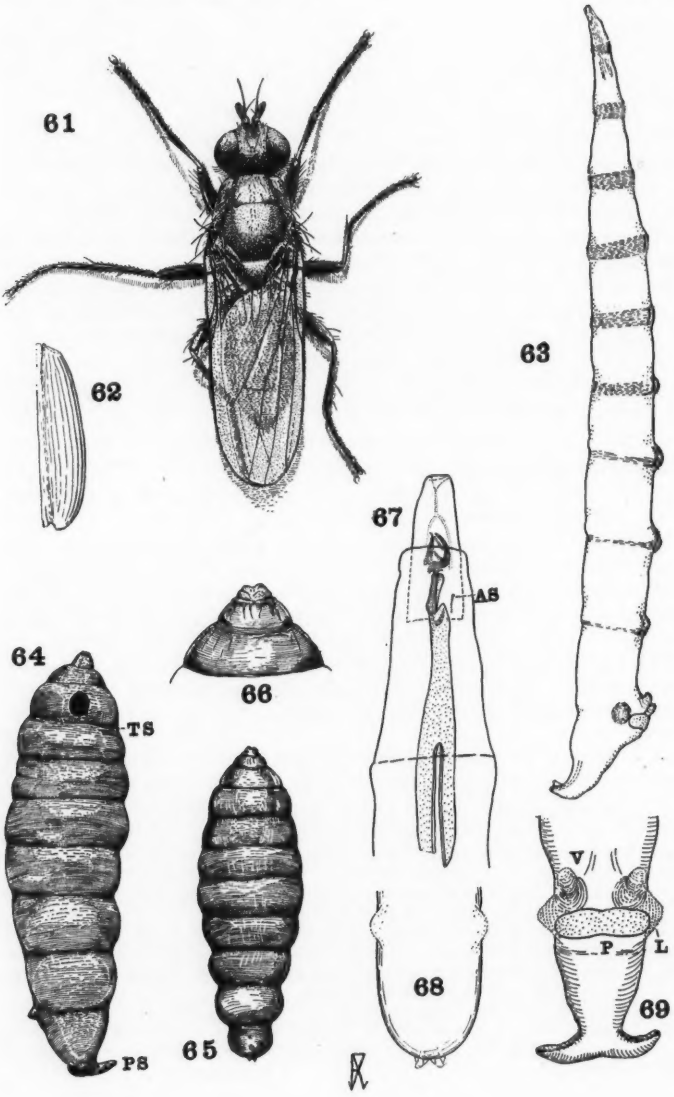
This alert, chiefly sooty brown fly of nearly the size of the common housefly ranges along our watercourses from a few hundreds of feet above sea-level to far into the mountains. It is found on the Island of Oahu where it inhabits both the Koolau and the Waianae Ranges.[1] Its apparent scarcity may be accounted for to some extent by a specialized habitat—the steep and even overhanging, usually wet surfaces of boulders alongside little cataracts or rapids. On such a background, often in the shadows, it may not be easily dis-

LISPOCEPHALA

Explanation of Plate IX

61. *Lispocephala fusca,* female. Length to tip of wings 6.4 mm.
62. *Lispocephala fusca,* egg, side view. Length, 1.2 mm.
63. *Lispocephala fusca,* larva in last instar, side viey. Length 11.5 mm.
64. *Lispocephala fusca,* puparium, dorsal view. At the anterior end is the emergence hole of a parasitic chalcidid wasp. TS, one of the thoracic spiracles of the pupa; PS, posterior spiracles.
65. *Lispocephala kaalae* n. sp. puparium. Length 5.1 mm.
66. *Lispocephala kaalae* n. sp. Anterior end of puparium more enlarged.
67. *Lispocephala fusca,* anterior extremity of larva from side to show pharyngeal skeleton. AS, anterior spiracle.
68. *Lispocephala kaalae* n. sp., posterior extremity of larva, from beneath.
69. *Lispocephala fusca,* posterior extremity of larva, from beneath to show anal plate, P; last pair of pseudopods; V, ventral and L, lateral tubercles.

[1] The same or very closely related species occur on some of the other Islands.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cerned. A flick of the wings will sometimes reveal its presence. The writer recalls an especially good catch of these flies—three females and seven males—the result of three hours' intensive search one morning in late September 1937, along a half-mile stretch of the Waihi-nui Creek, Manoa Valley, Honolulu. My collections indicate that the female is generally the more rarely seen. Along the Kaluanui Stream at an altitude of 2,000 feet or more in the Koolau Mountains, *Lispocephala fusca* shares its habitat with a large brilliant green dolichopodid fly, as yet undescribed, while along a spring on the cool heights of Mt. Kaala, Waianae Mts., we find it associated with the rather similar though smaller *Lispocephala kaalae* Williams, and with *Eurynogaster minor* Parent and several other brilliantly metallic-colored but smaller dolichopodids of the same genus.

Lispocephala fusca often remains perched upon its steep boulder for a considerable time. Sometimes its wings rest one quite overlapping the other; more frequently perhaps, they are in a slightly separated position so that their apices each form a lobe. Other species commonly hold their wings somewhat expanded as in our common housefly. It can turn about very quickly and seems ever on the lookout for prey. However, little is known about its feeding habits. When confined in a vial with a smaller fly, it may catch and feed upon it. Sometimes it makes a short though futile dash at the little ephydrid flies that often swarm on wet boulders. On a large boulder within the draft-borne spray of an immensely lofty waterfall on the large Island of Hawaii, *Lispocephala* near *fusca* was once observed attempting to overcome *Telmatogeton torrenticola* (Terry) a sooty black chironomid fly of considerable size. Some of our species have long been known to be carnivorous (see Perkins, R. C. L., Fauna Hawaiiensis, I, Part VI, p. clxxvii, 1913).

Eggs, larvae and puparia of *Lispocephala fusca* were secured, although no flies were reared. The fly sometimes oviposited in captivity. The egg (Pl. IX, 62, side view) is dead whitish, subcylindrical. It is longitudinally ribbed except on one side where it is flattened, gently keeled and bears a fine reticulate pattern. There are strong flanges that project as lobes somewhat beyond the body of the egg. It thus much resembles the egg of *Lispa metatarsalis* which, however, is dull olive brown.

A few large larvae, some good puparia and a considerable number of hatched puparia were found on steep Mt. Kaala, Waianae Mts., at an elevation of about 3,600 feet, where a spring, well sheltered by the huge roundish leaves of the *apéapé* (*Gunnera petaloidea* Gaud., Haloragidaceae) and by other leaves furnished the proper environment. Fine matted roots from nearby plants, and moss or liverworts holding accumulations of mud and over or alongside which a thin sheet of clear water steeply flowed, yielded this *Lispocephala* material as well as puparia of *Scatella* and larvae of Doli-

chopodidae and of a chironomid. The well-grown pale yellowish larva of *Lispocephala fusca* (Pl. IX, 63) with its almost needle-pointed retractile fore part measures 11 millimeters—more or less—in length. The paired mouth-hooks are simple, the prothoracic spiracles (Pl. IX, 67, AS) very small, most of the segments transversely striate anteriorly; ventrally there are paired setulose protuberances or pseudopods on the abdominal segments, the pair just anterior to the anal plate being particularly well developed (Pl. IX, 69, V). On each side of the anal plate is a spinulate subconic process. The puparium (Pl. IX, 64) is brownish and retains, in a more or less suppressed manner, some of the characters of the larva. As in the puparia of certain other Diptera (*Scatella, Brachydeutera,* etc.) it may often be unduly bent or otherwise distorted evidently, however, to no disadvantage. The thoracic spiracles of the pupa protrude through the puparial integument as small dark points (Pl. IX, 64, TS). The pupa is considerably shorter than the puparium, lying well forward within it. I was unable to hatch any puparia in the laboratory, but a puparium containing a male fly nearly fully developed showed it to be *Lispocephala fusca.*

The fly is sometimes parasitized in its early stages by a chalcidid wasp parasite of the family Spalangiidae. In fig. 64 is shown the fly puparium with a perforation near the anterior extremity through which two of these little wasps issued.

Lispocephala kaalae n. sp. (text fig. 1) was found associated with *L. fusca* on Mt. Kaala but appears rarer. It also is a dusky species but considerably smaller. The slightly yellowish larva has the posterior end well rounded with the spiracles mounted on short processes (Pl. IX, 68). The puparium likewise has these processes quite short.

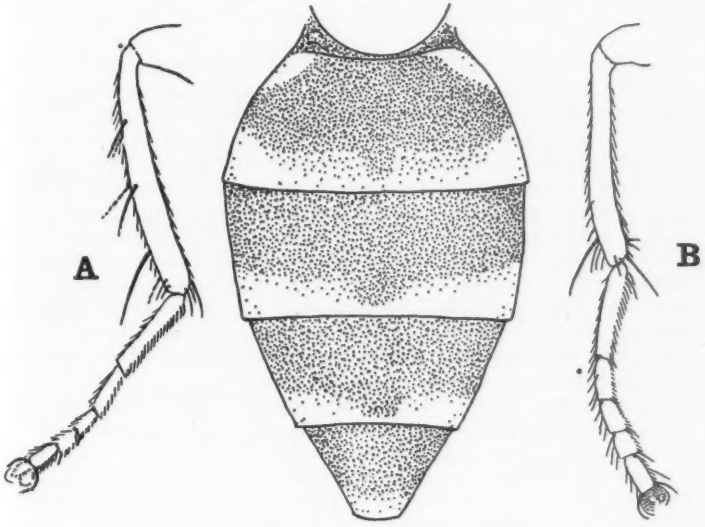
The Hawaiian species of the genus *Lispocephala* have been monographed by Dr. J. R. Malloch (Proc. Hawaiian Entomological Society VII, pp. 67-89, 1928).

Lispocephala kaalae n. sp. (Text fig. 1, dorsum of abdomen of female paratype, to show pattern; A, tibia and tarsus of left posterior leg, posterior view; B, tibia and tarsus of left anterior leg, posterior view).

Female.—Head pollinose as follows: frons, vertex and occiput in part golden brown; face grayish white, parafacials pale brown; cheeks grayish white, some brown at vibrissal angles; antennae and arista black; palpi fuscous, brownish at base. Thorax brown dusted above, generally pale gray dusted elsewhere. Abdomen dusky brown above and extending laterally on 2-4; pale gray dusted on apex of 1-3, rather obscurely on apex of 4, also on each side above at base of 1; elsewhere pale gray. Legs pale gray, but knees brownish; tarsi with brownish tinge. Wings slightly smoky. Calyptrae whitish. Halteres yellow.

Frons at vertex about one third of the head width, triangle extending to frontal lunule; arista pubescent on basal half. Anterior presutural pair of dorsocentral bristles about half as long as posterior pair; both pairs of intra-alars

present. Abdomen not strongly bristled. Mid tibia with a median posterior bristle; hind tibia with three anterodorsal and three posterodorsal bristles, preapical dorsal bristle somewhat less than the length of metatarsus. Length 4.1 mm.



Text Fig. 1

Type: Mt. Kaala, Waianae Mts., Oahu, 3600 ft., Sept. 7, 1936 (F. X. Williams); paratypes: one female, same data, and one female issued ex puparium from wet moss of bank of *Gunnera* spring, Mt. Kaala, 3600 ft., July 13, 1933 (F. X. Williams). Type and one paratype in the collection of the Hawaiian Entomological Society. One paratype deposited in the B. P. Bishop Museum.

Related to *L. fusca* Malloch, running down in his key to couplet 19 a. Differs from *L. fusca* chiefly in its smaller size, shorter head, gray-banded abdomen, generally pale gray dusted body, and generally more feeble chaetotaxy.

Campsicnemus fumipennis Parent (Diptera, Dolichopodidae)[1]

BY FRANCIS X. WILLIAMS
Experiment Station, H.S.P.A.

(Presented at the meeting of November 4, 1937)

Carved out of the leeward slope of precipitous Konahuanui, Koolau's highest summit, the little Lulumahu Canyon upstream from the wild narrow leap of its waters into Nuuanu Valley follows at first a relatively straight course. At the upper end of this stretch a short distance before the canyon winds its tortuous diminishing way into the heart of the mountain mass a small close-set grove of tall banana plants—one of many such to be found in faraway places in Hawaiian mountains—clings to a steep slope right beside a waterfall. Within this grove the sunlight penetrates none too strongly, often there are deep shadows and always it seems dank, for we are at an elevation of nearly 2,000 feet, in a region of frequent mists and heavy rainfall, the mossy forest of the tropics. All around, the low trees, the shrubs and much of the soggy forest floor are clad in moss, liverworts and fern, but the tall stems of the bananas save for a scant drapery of their own withered leaves stand forth nakedly though interrupted in their smoothness by outer sheathings that are dead and drying. Underfoot there is an admixture of rock, mud, decaying plant tissue and dripping green banks. And more or less intermingling with the bananas are lesser plants often with succulent leaves and brittle stems — the rambling fiber plant or *olona* (*Touchardia latifolia* Gaud.; Urticaceae), a tangled growth of the shrubby dark-leaved *Cyrtandra paludosa* Gaud. (Gesneriaceae) invading the grove, a more herbaceous *Cyrtandra* being less common while one of the numerous representatives of the genus *Peperomia* (Piperaceae) grows close to the earth. Of note also is the curious fern *Polypodium spectrum* Kaulf. with erect ivy-leaf like fronds from a rhizome that creeps along the ground or nearby in the forest, ascends some mossy limb.

Various insects and other invertebrates flourish in this damp shady grove. A close study of its fauna would yield a long list. Some of the forms may be noted here. Obvious enough is a flatworm or planarian *Geoplana* sp.,[2] dark, slimy and somewhat over an inch in length that glides along, its pointed head often raised from the ground in search of prey. Such a flatworm was once seen to attack and overcome a small oligochaete earthworm that was greatly agitated; elsewhere it was observed feeding in numbers on a large

[1] Parent, O., Konowia, XVI, pp. 76-77, fig. 10, May, 1937.

[2] Dr. L. H. Hyman of the American Museum of Natural History has kindly undertaken to work out this species upon the receipt of better material.

earthworm that lay exposed on a mountain trail. This planarian also successfully entangles in its slime small Crustacea such as *Orchestia* and other invertebrates. *Succinea* snails with shell perched caplike on relatively large body, the delicate zonitid *Philonesia* near *baldwini* Ancey[3] encased in its flattish almost transparent pale brown shell, the tiny *Tornatellides*, probably *procerulus* Ancey[3] and an immigrant slug occur on leaf and stem, while an aquatic snail *Lymnaea* sp.[3] of foreign origin, abundant in the nearby stream is found also about the boggy floor of the grove. Among the Crustacea both the depressed or isopod and the compressed or amphipod forms occur, the leaping *Orchestia platensis* Kroyer climbing well up on plants, while a sowbug *Philoscia angusticauda* Budde-Lund and a much smaller form are also abundant. Two or more species of small centipedes, one a common lithobiid, conceal themselves in suitable places, while of millipedes the rather flattish inch-long *Orthomorpha gracilis* Koch is conspicuous on the ground and on banana stems. Spiders and mites are more or less apparent. Tiny indeed though not inconspicuous as they move about on banana plants are whitish collembolans. At least one of these primitive soft-bodied insects is of a variety with elongate antennae and, on provocation all leap vigorously. *Saldula* or "shore bugs" range throughout this humid region. The earwigs *Anisolabis eteronomma* Borelli and *Labia dubronyi* Hebard are present among decomposing stems. The damselfly *Megalagrion hawaiiense* (McLachlan) may be started yet pallid and weak-flying in its newness from near its nymphal shell on a banana stem; dark, fully matured individuals flit and rest among the shadows or engage in inserting their eggs in a dripping mossy bank. And occasionally we find nymphs of this species in various instars, on a banana stem, for the insect is scarcely more than semi-aquatic. A fungus midge breeds in decaying banana tissues while other tiny midges, as *Forcypomyia ingrami* Carter, hover in small swarms. The curious *Forcypomyia* larva creeps about soggy sun-sheltered plant materials. Long-legged crane flies or Limnobiidae, mostly *Limonia grimshawi* (Alexander) fly out of concealment from among dead banana leaves, the old stems supplying food and shelter for its larva. The big brisk soldier fly *Neoexaireta spinigera* Wied. of Australian origin as well as the widespread smaller species *Cephalochrysa hovas* Bigot breed in dead banana tissue. Here also flourishes the common syrphid fly *Syritta oceanica* Macq. Eleven species of drosophilid flies were taken in this banana grove. Some of these are handsome picture-winged species. The determinations[4] are as follows: *Drosophila immigrans* Sturt., *D. melanogaster* Meig., *D.* sp. near *melanosoma* Grims., *D.* sp. near *carinata* Grims., *D.* 2 spp. near *paucipuncta* Grims., *D.* sp. near *cognata* Grims., *D. lulumahu* Bryan, *D. deltaneuron* Bryan, *Idiomyia*

[3] Determined by Dr. Montague Cooke, Malacologist at the B. P. Bishop Museum, Honolulu.

grimshawi Bryan and *I. oahuensis* Grims. Some of the drosophilids were attracted to bunches of bananas, that were often badly eaten by rats. Of muscoid flies a handsome *Prosthetochaeta* near *lucilioides* Grims.,[4] with a shining blue abdomen, as well as the predacious *Lispocephala ingens* (Grims.) with polished brown body were occasionally found about decayed banana stems. Examining fallen banana stems revealed one or more carabid beetles and carabid larvae rather uncommon, *Osorius rufipes* (Motsch.) (Staphylinidae), *Dactylosternum subquadratum* Fairm.—adults and larvae —*Cercyon quisquilius* (Linne) (Hydrophilidae), and *Polytus mellerborgi* (Boh.) (Curculionidae).

Now, as we look again among the banana stems an alert brown fly suddenly alights before us (Fig. 6, male). In profile showing a body well raised on long strong legs it is able to survey a fairly extensive if very steep environment. Although not overwary it was surprising—before the writer developed a more cautious technique—how often it managed to get out from under the large vial descending overhead to imprison it. Seeming much to prefer shade to sunshine, it frequently rests quietly on a stem but is more commonly observed progressing in little exploratory runs, with very brief halts, going chiefly upwards, sometimes to one side or more rarely downwards. It may "about face" with great rapidity when something attracts it from the rear. Collembolans seem to form the chief food of this fly and, upon discovering a suitable one of these tiny insects—for the larger specimens do not appear to be as acceptable —the fly immediately follows close behind and at an opportune moment stoops very quickly to seize it in its bristle-rimmed tongue or labella.

While *Campsicnemus fumipennis* measures but a scant 4 millimeters in length of body it is the largest species of the genus thus far discovered in Hawaii. It comfortably exceeds in size the sooty black *C. miritibialis* Van Duzee, one of our next largest *Campsicnemus* and that at the time of these field studies might have been observed skating in swift graceful curves in shallow pools of the stream not a stone's throw away. The color of *fumipennis* is pale brown with two black stripes on the middle of the thorax, much blackish on its posterior part and obscuring bands predominating on the abdomen. The wings are somewhat infuscate chiefly along veins of the middle and apical fields (Fig. 5). The male bears two rows of long erect bristle-like hairs on the middle tibiae and one row on the middle femora.

This species was described from a single female taken on November 29, 1933, near the Moaula stream at 2,100 feet elevation in the mountains of east Molokai Island. My observations on its habits in the particular banana grove in the mountains behind Hono-

[4] Determined by E. H. Bryan, Jr., curator of collections at the B. P. Bishop Museum, Honolulu, who describes the new Drosophilidae in the present issue of the Proceedings.

lulu and a single observation in a similar grove in the Kaluanui Valley on windward Oahu at an elevation of about 2,000 feet show that it is predominantly arboreal in the adult stages.[5] It favored particularly the stems of bananas, ascending them rarely if ever to the crown. When it had completed an exploration it would fly lower down on the same stem or to another stem, or would alight on one of the withered banana leaves hanging near at hand and there renew its investigations. Occasionally one would fly to a small much decayed banana stump that lay nearby, chiefly along the ground and in which a few small dolichopodid larvae were later found, but which, however, may have been those of one or two small brown *Campsicnemus* species, as yet undetermined, that patronized this stump, the ground[6] nearby, and that not infrequently ventured well up a banana stem. More rarely was *C. fumipennis* found on the slender stems of *olona* in this Lulumahu banana grove.

But fragments of the life-history of this rather uncommon fly are to be gathered in its often inhospitable mountain home.[7] It occurs throughout the year, the males seeming to predominate. One morning in March 1937, a recently issued male, its wings still pallid and the body quite delicate was very readily captured from the extremity of a dried bit of banana stem that protruded upwards from a stump some 8-10 inches tall. A few days later a male and a female *C. fumipennis* were observed alongside a decaying portion of a standing banana stem. Some of this decaying portion was cut off and soaked in water in the laboratory thus revealing one small and another well-grown dolichopodid larva, two anthomyiid larvae probably those of *Lispocephala,* a number of *Limonia grimshawi* cranefly larvae, etc. The larger dolichopodid larva contained in its alimentary canal chitinized fragments of insects quite unrecognizable except for the head capsule of what appeared to be a psychodid fly larva. Captive *C. fumipennis* were induced to oviposit on decaying banana stem tissues, the eggs being barely imbedded in the somewhat translucent material. They are more pointed at one end, polished, amber yellow and about 0.54 mm. long (Fig. 1). They develop rapidly so that in a few days the young larva may be seen within, its head-frame a black spot with some parallel rods therefrom, becoming very apparent. It soon cuts a slit from the more pointed end of the egg down to about its middle length where it ends in a curve, and slips out of the shell. A few of the larvae were reared to a considerable size and one successfully pupated and produced an adult. The method employed in rearing consisted in placing

[5] On May 8, 1938, a female *C. fumipennis* was taken on the stem of a solitary banana plant in a narrow ravine at the base of Mt. Kaala, Waianae Mts., Oahu.

[6] The large *Dolichopus exsul* Aldrich is also on the wet ground here.

[7] Sixteen trips—from September 1936 to September 1937—were made to the mountains to study this fly.

a mass of decayed banana stem tissue on and partly into wet sand in a large glass receptacle and adding two or three decaying guavas (*Psidium guajava* Linn.). Some common pomace flies (*Drosophila melanogaster*) were then placed in the receptacle and finally several female *Campsicnemus fumipennis*. The drosophilids attracted to the decaying fruit in which they commonly breed, would oviposit thereon, the resulting maggots thus presumably serving as food for the predacious *C. fumipennis*. In this manner, placing the dolichopodid in such a receptacle on February 21, 1937, I secured by March 23, the single cocoon that on April 1 disclosed an adult female. The somewhat glassy *C. fumipennis* larva finally attains a length of about 7 mm. It is of the usual dolichopodid larva form (Fig. 2), tapering at the fore end and truncated and lobed at the posterior. Anteriorly the stigmata are very small; the posterior pair are well separated and surrounded by 4 lobes bearing small hair fans that help maintain a passage way in the wet material in which it lives. On the anterior ventral side of segments 5-11, and nearly on the middle length of segment 12 which bears the anal aperture, are low paired protuberances bearing curved rows of teeth of about the same color as the derm proper of which they are a part (Fig. 3). These tooth or spine rows aid in locomotion, and their nature and arrangement are important in the classification of the Dolichopodidae as well as of other groups of fly larvae. The cocoon is short oval and composed of a tough gelatinous material binding in this case, grains of sand. Through the fore end of the cocoon protrude the two slender respiratory horns of the pupa that can be made to converge or diverge to some extent. When emerging time is at hand the active pupa thrusts itself through the cocoon—and entirely free of it in the one case observed—to liberate the fly through fissures that form chiefly along the back between the respiratory horns and across the top of the head. The pupal shell is about 4 mm. long exclusive of the respiratory horns which are an additional 1.5 mm. It is a light yellowish brown, but darker on the front of the head, a band on the horns near their base, and along the spine-row area on six dorsal abdominal segments. There are three stout pointed processes beginning from the apex of the head and a fourth and paired one lower along the face. There is a bristle on each side of the apex, several pairs of

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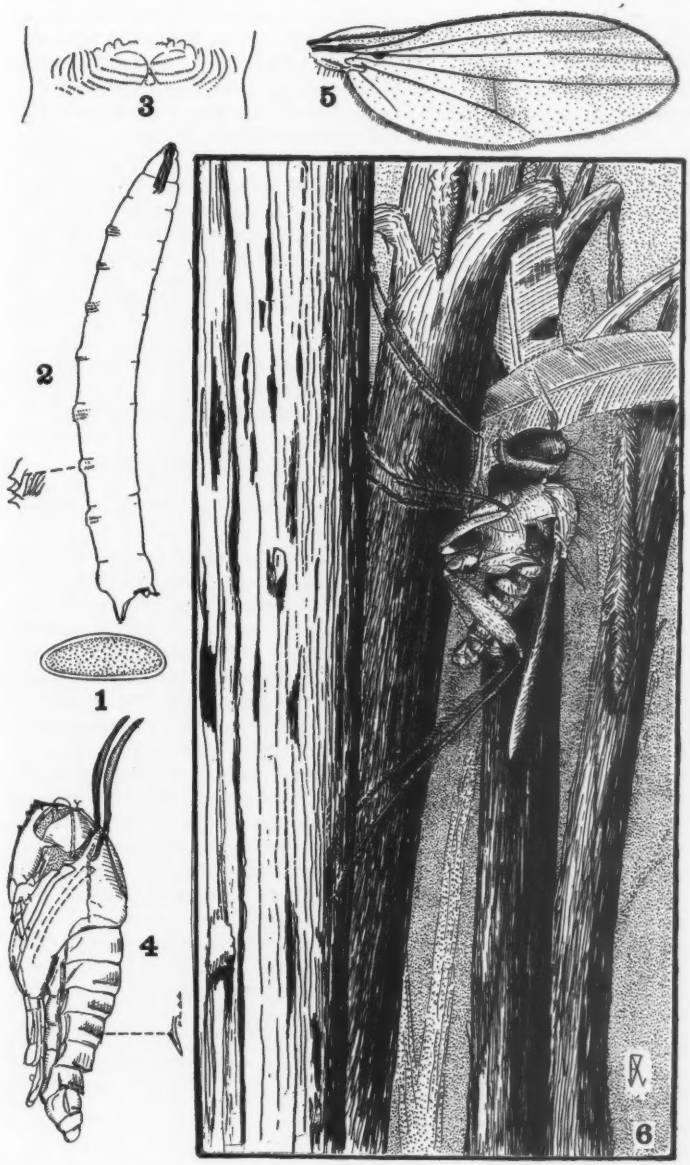
CAMPSICNEMUS FUMIPENNIS

Explanation of Plate X

1. Egg. Length 0.54 mm.
2. Larva—probably in last instar; side view. Length about 7 mm.
3. A pair of abdominal prolegs of larva showing arrangement of spine-like processes. Ventral view.
4. Pupal shell, female. Side view. Length exclusive of respiratory horns, 4 mm.
5. Wing of female.
6. The fly in its natural environment. Length from head to end of body, 3.75 mm.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fine spine-like processes along the dorsum of the thorax and a row of stout spines across the back of abdominal segments 2-7, with many stout spinules intermingled and anterior to them. The respiratory horns are somewhat flattened except at their base and are broadest at the middle. From near the base of this wide part of each horn, a line of dots—probably breathing pores—commences and extends to, and for a short distance hook-like over, their extremity.

From time to time a tall stalk having yielded its cluster of fruit and buffeted perhaps by sudden wind or loosed by winter flood, falls to earth, the young shoots about its base striving among themselves for the space and light thus released. And so the banana grove in its growth and in its decay supplies a convenient and sometimes a necessary shelter and sustenance for a number of insects and other invertebrates that are gathered beneath its shadows. And of all such tiny creatures none seems more at home there than the alert, smoky-winged *Campsicnemus* fly.

Asyndetus carcinophilus Parent (Diptera, Dolichopodidae)[1]

BY FRANCIS X. WILLIAMS
Experiment Station, H.S.P.A.

(Presented at the meeting of December 3, 1937)

The entrance to the holes of the common ghost crab (*Ocypode ceratophthalma* [Pallas]) of our sandy beaches is a favorite resort of several species of flies. Largest and most conspicuous of these is *Asyndetus carcinophilus* (Pl. XI, 1), a rather bristly, white-bearded fly, the generally grayish color of which is varied by reflections of greenish and bronzy. Here it finds shelter from the glare and heat of the sun as well as from cooling winds. Not venturing more than a few inches within these burrows, but stationing itself rather at the very entrance of relatively large and often abandoned ones this wary insect is able to dart out to safety at one's approach. When the danger is over it will work its way back to the selfsame or to another crab hole. Higher up on the beach the fly is also found where there are suitable depressions. Other flies, all of small size, that were observed at or near the entrances to the burrows of the *Ocypode* crab were: a grayish agromyzid, the rather similarly colored ephydrid, *Hecamede persimilis* Hend.,[2] an occasional dark shining species as yet undetermined but apparently also an ephydrid, a borborid, and quite rarely the very swift empid *Chersodromia hawaiiensis* Melander—described in this issue. *Asyndetus* was not

[1] Abbé O. Parent is describing this and several other species of Hawaiian Dolichopodidae.

[2] Determined by E. T. Cresson, Jr.

seen preying upon any of these although sometimes it did briskly pursue its smaller neighbors. But along the moist strand, well beyond the wash of the tide the fly may often be observed usually working against the breeze, proceeding in short runs, occasionally teetering its mouth against the sand and shifting its ground by a swift low flight. It seems that here *Asyndetus* feeds upon the tiny delicate jelly-like masses—the only organic matter the writer was able to discover in a brief examination of some of this sand.

Asyndetus is easy to rear. The flies mate readily in large vials and are frequently seen pairing in the entrance of crab holes. The male fly lacks the usual tarsal claws; these may however be incorporated in the terminal pads or pulvilli which are particularly large and long (Pl. XI, 3) and are probably of use in grasping the female.

The eggs (Pl. XI, 2) are oval and measure about 0.65 x 0.30 mm. They are very pale creamy brown, tinged with yellow though dusky at the smaller extremity. Under good magnification they appear smooth and polished. Captive flies glued their eggs to the sides of the glass vials. Some of these eggs hatched in about 10 days. For rearing larvae a large glass receptacle was partly filled with moist beach sand. Several overripe to decaying guava (*Psidium guajava* L.) fruits in which drosophilid flies were likely to be breeding were then partly buried in the soil and some adult drosophilids for egg-laying were introduced. Finally, the vials with the *Asyndetus* eggs were placed mouth down on the sand. It became evident some weeks later that the resulting *Asyndetus* larvae were faring well upon the drosophilid maggots, for 10 large more or less yellowish larvae were sifted from the sand in this receptacle. The *Asyndetus* larva is of the usual cylindrical dolichopodid form, tapering at the fore end and subtruncate at the rather bulbous posterior one. At this posterior end the four large lobes are provided with the usual though in this case relatively small hair tufts. The low paired ventral swellings or pseudopods of the abdominal segments bear a row of fine beaked carinulae extending fore and aft, while just posterior to these curve lower carinulae with their margins finely setulose (Pl. XI, 7). The pharyngeal skeleton (Pl. XI, 9, V and D) is relatively stout. A pair of thoracic spiracles is present. The caudal spiracles (Pl. XI, 8, S) are situated towards the base of the upper lobes. A large moderately extended larva is about 12 mm. long. A single larva was secured well up a beach in sand in which an old flower-and-leaf garland or *lei* was partly buried. I suppose that this decaying plant tissue had attracted other flies, the larvae of which are partial to such materials and that the carnivorous *Asyndetus* was preying upon them. The 10 sifted *Asyndetus* larvae were placed in sand in metal salve boxes where upon examination a couple of weeks later, several strongly-made short-oval cocoons consisting of sand grains bound together by a delicate shining membrane-like material were found (Pl. XI, 6). Within the cocoon the larva casts its skin for the last time to

transform into a stout creamy yellow pupa (Pl. XI, 4) with segmental bands of reddish brown bristles on the back of the abdomen and a band of much larger and thicker curved ones on the metanotum. The respiratory processes anteriorly on the thorax are sharply pointed and relatively short for a dolichopodid fly. In a little more than two months after the ovipositions by the parent flies, three individuals issued from the cocoons during morning hours. The pupa armed with a sharp cocoon-piercing head process forces its way wholly or in part out of the cocoon, by movements of its spiny abdominal segments, part of the head and thoracic integument splits and the fly crawls forth. At first its abdomen is rather elongate while the wings are quite short, narrow and incurved apically. In a few minutes however, the body shortens to its normal length and the wings reach their full development.

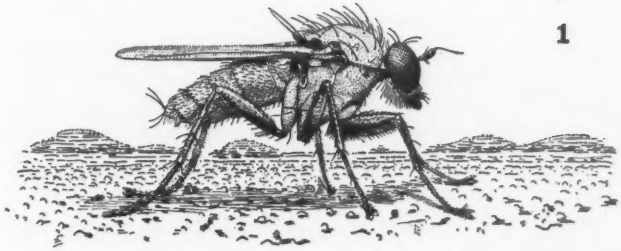
Asyndetus carcinophilus is common on the sandy sea beaches of the Islands of Oahu, Maui and Molokai, and probably has a wider distribution than that in the Archipelago. Judging from the following observation it may not be on friendly or indifferent terms with the *Ocypode* crab, the entrance to whose burrows it so often patronizes: "Near Koko Head, Oahu, November 25, 1937. One of these flies advanced by degrees towards a small crab hole at the immediate entrance to which the occupant was posted sideways. When the fly had come almost up to the crustacean, the latter with a quick movement ran over it, seized it in its claws and then backed rapidly down its burrow."

There are at least three additional species of maritime Dolichopodidae (*Hydrophorus* 2, and *Cymatopus* 1) in the Hawaiian Islands. These however, favor different habitat areas.

ASYNDETUS CARCINOPHILUS

Explanation of Plate XI

1. Male. Length from base of antennae to tip of wings 5.15 mm.
2. Eggs. Length 0.65 x .30 mm.
3. Last joint of hind tarsus of male from above—showing highly developed pulvilli.
4. Pupa from the side. Length 4.6 mm.
5. Wing.
6. Cocoon of sand grains. Length 7 mm.
7. Serrations ventrad on abdominal segment of larva.
8. Caudal extremity of larva, hair tufts not shown. S, Stigma.
9. Pharyngeal skeleton, dissected. V, ventral portion slightly inclined from the lateral; D, dorsal portion viewed from the dorsal side.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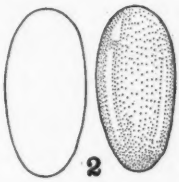
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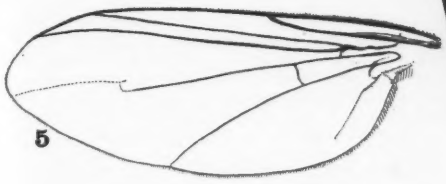
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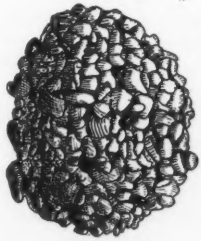
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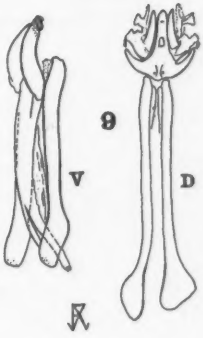
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Two Insect Immigrants New to the Hawaiian Fauna

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of March 4, 1937)

The two following species have heretofore not been recorded from the Hawaiian Islands. Both are American:

Order COLEOPTERA

Family CURCULIONIDAE

Stenopelmus rufinasus Gyllenhal.

Four specimens of this semi-aquatic weevil were collected by Dr. H. Lyon from *Azolla* at Honolulu, in November 1909. It has remained undetermined in the Sugar Planters' collection and has evidently not been collected since that time. It may not have become established here, but it is worthwhile to record it. Its small size and peculiar biology, however, may have kept it hidden from collectors. It ranges through the southern United States from California to Florida and has been recorded from as far north as Indiana.

It may be briefly characterized as follows:

Form stout and rather subquadrate; derm black, with the appendages for the most part reddish; densely clothed with scales above and below, the scaling normally completely concealing the derm; mottled with black, pale brown and grey scales above, scaling grey below. Rostrum short and stout, not much longer than the head. Antennae with the funicle seven segmented, the first segment ovoid, almost as long as the two following segments together. Elytra finely striate; abruptly angulate at the shoulders and there much broader than the prothorax; with a patch of pale scales on each shoulder. Scutellum with grey scales. Tarsi long and slender, the fourth segment as long or longer than the three preceding segments together. Length, 2 mm.

There is no other Hawaiian weevil with which this species might be confused. A small, robust weevil, densely squamose both above and below and collected on floating aquatic plants in or along streams or ponds will probably be this species.

Order DIPTERA

Family DROSOPHILIDAE

Chymomyza procnemis (Williston).

Several specimens of this fly were collected by Dr. Walter Carter and Mr. K. Ito in pineapple fields C.P.C. 6 and 84 at Kunia, Oahu in November and December 1936. The flies were hovering about young flowering pineapple fruits and diced stumps. It is a widely distributed species known from such regions as Panama, Brazil, West Indies and from the eastern part of the United States as far north as New Hampshire.

The genus has not been heretofore recorded from the islands. The following short synopses will distinguish it from the other genera of the Hawaiian Drosophilinae:

Arista plumose. Lower reclinate orbital bristle large and placed below the proclinate bristle and nearer the proclinate than to the upper reclinate bristle; postvertical bristles small; eyes bare. Wings with only one cross vein between the third and fourth veins.

The species may be briefly characterized as follows:

Front yellowish, the narrow orbitals greyish. Antennae with the first two segments yellow, the third brownish; arista with three long and one short bristles above and two long bristles below. Thorax shining, reddish-yellow or pale reddish-brown; the setae shining black. Abdomen shining black and sharply contrasted with the pale thorax. Fore femora, for the most part, fore tibiae and fore metatarsi black, the legs otherwise yellowish. Wings not spotted, the costal cell appearing infuscated owing to its dense, black setae, the wings otherwise greyish and concolorous except for the apex which is slightly paler; third and fourth veins slightly convergent distally; the ultimate segment of the costal vein about three fifths as long as the penultimate segment; the penultimate segment of the fourth vein two fifths as long as the ultimate. Length of the body without wings, 2 mm.

This small fly may be readily recognized offhand in the field by its yellowish or reddish thorax and sharply contrasting shining black abdomen, and by its pale mid and hind legs and mostly black fore legs.

Note on Typhlonesiotes swaluwenbergi Jeannel (Coleoptera, Carabidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of April 1, 1937)

In the Haw. Ent. Soc., Proc., vol. 8, no. 1, p. 24, 1931, there appears the following note: *"Macranillus atomus* Jeannel.—Paratype specimens of this newly described minute Carabid received from Dr. G. A. K. Marshall were exhibited by Mr. Van Zwaluwenburg".

Mr. Van Zwaluwenburg recently called to my attention Dr. Jeannel's splendid monograph entitled "Les Bembidiides Endogés", Rev. Française D'Entomologie, vol. 3, fasc. 4, 1937. In this paper, pp. 323-325, Dr. Jeannel creates a new genus for the minute, blind, soil inhabiting carabid mentioned in the quotation above. This species is to be known by the name *Typhlonesiotes swaluwenbergi* Jeannel, and constitutes a new genus to the Hawaiian carabid fauna. *Macranillus atomus* Jeannel was a manuscript name and was never printed.

Dr. Jeannel states that this new genus and species bears an

extraordinary resemblance to *Anillopsis capensis* from Africa, and that if it were not for its geographical isolation from the African species, he would hesitate to maintain the two genera as distinct. It is probable, I believe, that this species has been introduced and has not yet been discovered in its true homeland.

On Limnastis and Nesomicrops (Coleoptera, Carabidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of April 1, 1937)

In his "Revision of the Genus Limnastis" (Soc. Ent. de France, Livre du Centenaire, pp. 167-187, 1932), Dr. Jeannel described a new species from Oahu, *Limnastis swaluwenbergi,* and erected a new subgenus, *Paralimnastis,* for its reception. On page 169 he makes the following remarks which, freely translated read as follows:

"It is impossible for me to express an explicit opinion on the small Hawaiian Bembidiides described by D. Sharp (1903, Fauna Hawaiiensis, III. pp. 286-287). Their description is unfortunately too short. The two species known to Sharp have been placed by him in two new genera, *Nesomicrops kauaiensis* Sharp and *Macranillus coecus* Sharp, differing only, he says, by the degree of regression of the eyes, which are reduced in the first, absent in the second. One can deduce from the term of their description that the two species are not likely generically different and that *Macranillus* must vanish from the nomenclature. But I then ask if these two *Nesomicrops* of Kauai are really allied to *Nesocidium,* that is to say to the *Bembidium* of Oahu as D. Sharp affirms. One will find the description of *Limnastis Swaluwenbergi,* n. sp., from Oahu further on. Should *Nesomicrops* of Kauai not fit the same genus?"

Dr. Jeannel, unfortunately, did not see specimens of either of Dr. Sharp's genera, and it is true that Sharp's descriptions are so incomplete as to be of little use in problems where details are necessary.

In suggesting the merging of the genus *Macranillus* with *Nesomicrops* I concur, but I have not seen a specimen of *Macranillus coecus,* and I know of no record of its capture since the unique type was collected by Dr. Perkins in 1896. It must, therefore, remain for someone with specimens of both *Nesomicrops kauaiensis* and *Macranillus coecus* in hand before this problem can be accurately solved.

Dr. Jeannel finally suggests that both of these genera probably belong to *Limnastis.* Such a statement would never have been made had he had access to specimens of *Nesomicrops.*

I have before me one of the four original specimens of *Nesomi-*

crops kauaiensis Sharp, collected by Dr. Perkins in 1896, together with a topotype of *Limnastis* (*Paralimnastis*) *swaluwenbergi*. The two species bear no resemblance to one another, and they surely cannot belong to the same genus. *Nesomicrops kauaiensis* is a convex oval insect, the pronotum of which has two setae on each side, is otherwise smooth and shining and without discal setae, the base is truncate and fits tightly against the base of the elytra; the elytra do not have a row of dense, erect setae on each interval but are bare except for the usual marginal setae and the discal setae on the third interval. *Limnastis swaluwenbergi,* on the other hand, is an elongate, depressed insect whose pronotum is comparatively densely setose, there is a distinct "neck" at its base which prevents its being closely and broadly joined to the elytra. The elytra have a row of rather dense setae on all of the intervals. The terminal segment of the maxillary palpus on *Limnastis swaluwenbergi* is hardly discernible and but a small fraction as long as the ultimate segment of the labial palpus. On *Nesomicrops* the terminal segment of the maxillary palpus is conspicuous, well developed and fully as long as that of the labial palpus. *Nesomicrops* at first glance superficially resembles some of the small Hawaiian pterostichids but most greatly resembles and is closely allied to the bembidiid genera *Nesocidium* and its allies.

Beside these differences there are others that will definitely prove without doubt that the two genera are not at all closely allied. *Limnastis swaluwenbergi* is not allied to, nor does it resemble any of our Hawaiian bembidiids. I am of the opinion that it is an introduced species, which because of its small size and its hidden life in the soil, together with the specialized technique required for its capture, has not yet been collected in its native land.

On Chaenosternum With a Key to the Genera of Hawaiian Cryptorhynchinae (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of May 6, 1937)

Among the "lost species" of the Hawaiian fauna has been the cryptorhynchine weevil *Chaenosternum konanum* Blackburn, which was described in 1885 from a unique and has evidently not been recorded since. On January 23 of this year, I sifted one specimen from dead leaves and ground litter on the north side of the crater on Mt. Tantalus. Since then I have found two specimens among some material collected by Mr. Giffard and sent to Dr. Perkins for determination. One of these specimens was collected on Mt. Tantalus, September 29, 1907 and bears the following label "Amongst

dead leaves on ground under *Elaeocarpus* tree (damaged specimen after capture)." The head and prothorax are missing and Dr. Perkins returned it labeled "not determinable R.C.L.P." The other specimen was collected at the same place on February 25, 1906 "From dead branch of *Elaeocarpus* tree" and bears the following label written by Dr. Perkins "condition too bad for determination. It may be *Acalles pusillissimus* P. which I only found on *Pipturus*."

This species is evidently very rare, for several collecting trips to the same locality failed to reveal additional specimens. I have seen only the three specimens mentioned here; they were probably all taken within a few yards of each other.

From the dorsal aspect *Chaenosternum konanum* Blackburn, does suggest the appearance of a small, abraded, non-tuberculate *Acalles,* but an examination of the sternum will easily distinguish the genus. The following brief description includes the more salient characters:

Derm reddish-brown to piceous. *Eyes* small, coarsely faceted, five or six facets broad. *Antennae* inserted at about the basal third of the non-striate, non-carinate rostrum; scape short, stout, about as long as the first four funicular segments; first two funicular segments elongate, subequal in length, three to seven moniliform. *Prothorax* longer than broad (3.5:3), irregularly, variably, longitudinally impressed in the basal half along the median line and on either side; apex somewhat subtubular; closely set with conspicuous setiferous punctures. *Elytra* with the third and fifth intervals variably elevated at the base, the alternate intervals each with a row of short, erect or suberect setae; striae about one-third as broad as the intervals, the punctures elongate, shallow. *Legs* with the femora edentate; tarsi with the third segment but slightly emarginate distally and not bilobed. *Sternum* with the pectoral canal squamose; mesosternal receptacle a squamose, posteriorly rounded, almost plain projection between the mesocoxae, entirely open and without walls; metasternum short, not much longer at the middle than a metacoxa, densely squamose like the mesosternum. *Venter* with the ventrites all on about the same plane, second slightly longer than third, often more or less fused with first. Length, 1.8-2 mm.; breadth, 0.8-1 mm.

It is now possible for me to give a key to the Hawaiian genera of the subfamily Cryptorhynchinae. Only two genera, *Acalles* and *Chaenosternum,* have endemic species in these islands. *Chaenosternum* is known only from Oahu, *Acalles* is almost cosmopolitan but is composite. The other genera, *Anaballus, Cryptorhynchus, Elytroteinus, Euscepes* and *Mirastethus* are each represented by one alien species most of which are of lesser or greater economic importance. The paucity of Cryptorhynchinae in Hawaii is in decided contrast to the rest of Polynesia where these weevils form one of the most dominant constituents of the faunas of the high islands.

1. Scutellum visible 2
   Scutellum not visible 3
2. Femora toothed ..... **Cryptorhynchus mangiferae** (Fabr.)
   Femora edentate ..... **Mirastethus bituberculatus** (Fabr.)
3. At least the fore femora finely or strongly toothed 4
   Femora edentate 6

4. Pectoral canal squamose.....**Anaballus amplicollis** (Fairm.)
   Pectoral canal bare..... 5
5. Ventrites one and two fused at middle, second fully as long as 3 plus 4; tooth on anterior femora large, acute, conspicuous, other femora with indistinct teeth.....**Elytroteinus subtruncatus** (Fairm.)
   Ventrites all free, sutures between them distinct, second hardly longer than third; femoral teeth all small and inconspicuous; elytral intervals each with a single row of long, erect, conspicuous setae.....
   .....**Euscepes postfasciatus** (Fairm.)
6. Mesosternal receptacle deep and cavernous, with strongly protuberant walls.....**Acalles,** 22 species
   Mesosternal receptacle open, without walls; pectoral canal squamose
   .....**Chaenosternum konanum** Blackburn

Imalioides pusillus Karsch, 1881, is a synonym of *Anaballus amplicollis* (Fairmaire), 1849, and the latter name should be used in our records.

Stenotrupis of Samoa and Hawaii (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of June 3, 1937)

Mr. L. L. Buchanan recently sent me a series of a small *Stenotrupis* (Cossoninae) to be identified for the United States Bureau of Entomology. The specimens were taken from Samoan coconuts examined at quarantine in Honolulu. They belong to the same species as that recorded in a note by Mr. Otto Swezey (Proc. Haw. Ent. Soc., vol. 8, no. 2, p. 235, 1933) as *Stenotrupis filum* Fairmaire. Owing to the mixing of two species under one label at the British Museum, this name was a misidentification; the species is new.

I wish to express my sincere thanks to Sir Guy A. K. Marshall for his invaluable aid to me in solving this problem, and it is with much pleasure that I dedicate the new species to him as a token of appreciation.

Both Samoa and Hawaii have had but one species of the genus *Stenotrupis* recorded from them. Keys for the separation of the Samoan and Hawaiian species and a description of the new species follow.

Key to the Hawaiian Species

Three to over five mm. long; head with a very prominent subbasal constriction continuing deeply across the dorsum; scrobes lateral, short, shallow and inconspicuous; on tree ferns in the mountains.....**S. prolixum** (Sharp).

Less than two mm. long; head with the subbasal constriction inconspicuous, shallowly impressed on the sides and not impressed across the dorsum; scrobes deep, passing rapidly beneath, separated by a very thin median carina between the eyes below; on sugar cane and other introduced plants in the lowlands.....
.....**S. marshalli** Zimmerman

Key to the Samoan Species

Head with a conspicuous, deep, sharply defined, continuous, transverse constriction behind the middle, punctuation coarse, very dense and subconfluent distad of the constriction; prothorax very densely, coarsely, subreticulately punctate, the punctures almost touching one another, their interstices not more than half as broad as their diameters.....**S. myristicae** Marshall.

Head at most shallowly impressed on each side behind the middle, not impressed across the dorsum, finely punctate, the punctures small and distinctly separated; prothorax with small, rather shallow punctures, usually separated by distances about equal to their diameters on the disk, never coarsely punctate.....**S. marshalli** Zimmerman.

Stenotrupis marshalli, new species (fig. 1,b).

Derm moderately shiny, uniformly reddish-brown with the eyes and anterior half of the head black.

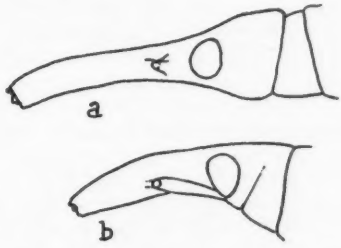

Fig. 1.—Outlines of female *Stenotrupis:* a, head and rostrum of *S. myristicae;* b, head and rostrum of *S. marshalli.*

Head slightly longer than broad, slightly, but distinctly constricted on the sides at about half way between the eyes and prothorax, the constriction not, or very inconspicuously continued across the dorsum; longitudinal dorsal contour gently convex; finely punctate, the punctures distinctly separated; interocular area slightly narrower than the base of the rostrum, without a median fovea. *Rostrum* subcylindrical, gently arcuate, distinctly longer than the head (4:2.5), similar in both sexes, longitudinal dorsal outline continuous with that of the head, slightly expanded on the sides above the insertion of the antennae, thence gradually and slightly expanding to the apex; scrobes well defined, passing beneath the eyes and separated below them by a distinct, sharp median carina; finely punctate throughout and with minute, inconspicuous setae excepting a few hairlike setae at the apex. *Antennae* inserted at about the middle of the rostrum in both sexes, scape as long as the five funicular segments plus one fifth of the club; first funicular segment stouter than the others, not quite as long as two plus three, two about as broad as long, three to five transverse and successively slightly broader; club ovoid, as long as the preceding four and one half funicular segments. *Prothorax* four fifths as broad as long, base truncate, rather evenly arcuate and gradually narrowed on the sides from about the basal third to the rather strongly marked, collarlike, subapical constriction; disk distinctly flattened, the longitudinal dorsal outline flat and even behind the sub-

apical constriction; punctures small and shallow, distinctly separated on the disk, the interstices about equal to, or frequently greater than their diameters. *Elytra* not quite three times as long as broad (2.5:7), longer than the prothorax in the same proportions, subparallel-sided from the base to about the middle of the second ventrite; striae narrow and shallow, their punctures small and shallow, each usually bearing a minute, hardly discernible seta; the intervals flat, broader than the striae, not distinctly sculptured; each bearing a single row of minute setae. *Legs* with the fore tibiae with a small, sharp tooth on the inner apical angle, the other tibiae with at most an indistinct denticle; third tarsal segment slightly broader than the second. *Sternum* more or less flattened throughout, with small separated punctures. *Venter* with first two ventrites fused and together about half again as long as the following three ventrites, convex in the female, shallowly concave down the middle in the male, closely set with small, setigerous punctures; intercoxal process of the first ventrite broadly Λ-shaped; ventrites 3-5 with a basal row of coarse punctures, ventrite five densely punctate at the apex and there with a median impression in the male but convex in the female. Length, 1.6-1.8 mm.; breadth, 0.4-0.5 mm.

Samoa and Hawaii. Holotype, presumably a male, stored in Bishop Museum, from Waialua, Oahu, Hawaiian islands, April 23, 1908, from sugar cane; 12 paratypes and one broken specimen from under leaf sheaths of sugar cane collected by Mr. Swezey on Oahu in 1908; one broken specimen found on the bark of algaroba at Waipio, Oahu, December 17, 1914; one paratype from Ewa Plantation, Oahu, collected by Dr. Williams March 29, 1932; seven paratypes taken from Samoan coconuts intercepted in quarantine at Honolulu, June 22, 1923; two paratypes found on a coconut from Tutuila, Samoa, at Honolulu, August 17, 1931; five specimens intercepted at Honolulu from coconuts from American Samoa as follows: two paratypes and two broken specimens October 8, 1930, and one paratype April 1, 1932. Paratypes have been placed in the United States National Museum and the Hawaiian Sugar Planters' Association.

In spite of the fact that the species has been introduced into Hawaii at intervals for the past 20 or more years, it has not become common and is rarely met with. It is probably a general feeder on such materials as the husks and dead fronds of coconuts, dead sugar cane leaves and other materials of like nature.

This species may be distinguished by its small size, and slightly constricted, mostly black head. From its Samoan and Hawaiian congeners it is very distinct because of its smaller size and its poorly-developed subbasal cephalic constriction together with the structure of its scrobes.

Stenotrupis marshalli is an aberrant species, and I believe that the abnormal structure of the head and scrobes will eventually necessitate its removal from *Stenotrupis*. However, it is perhaps best that it remain in *Stenotrupis* until a more representative collection of species of that genus can be critically studied. Sir Marshall writes that the New Zealand and other Pacific species always have

a marked cephalic constriction, "but in the species described by Champion from the Seychelles this character seems to disappear gradually".

Proeces filum Fairmaire 1849 is, according to Sir Marshall, a typical *Stenotrupis* with a marked subbasal cephalic constriction. In transferring *Proeces filum* to *Stenotrupis* it becomes necessary to give *Stenotrupis filum* Champion (1914) from the Seychelles, a new name. The corrections are as follows:

Stenotrupis filum (Fairmaire), new combination.
Proeces filum Fairmaire: Rev. Mag. Zool., ser. 2, vol. 1, p. 523(?), 1849.

Stenotrupis championi, new name.
Stenotrupis filum Champion: Trans. Linn. Soc. London, ser. 2, vol. 16, pp. 465, 469, 1914.

According to the description, *Stenotrupis filum* (Fairmaire) greatly resembles *S. marshalli.* The absence of the subbasal cephalic constriction will readily separate *S. marshalli,* however.

Heteramphus of Oahu (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of June 3, 1937)

The peculiar cossonine genus *Heteramphus* Sharp, is confined to the Hawaiian Islands. This genus contains 12 species, including a new one described herein. Seven of these species are found on Oahu, one on Kauai, one on Molokai, and three on Maui. The species known to occur on Kauai, Molokai, and Maui are each represented by unique types only, with the exception of *H. haleakalae* Perkins from Maui. None of these extra-Oahu species has, to my knowledge, been captured since Dr. Perkins collected the types. It is probable that new species await the collector throughout the islands.

Owing to lack of material I cannot review the genus as a whole, but I have before me specimens of all the known species from Oahu and can now give a key to aid in their identification.

To my knowledge, no genotype has been designated for the genus. *Heteramphus wollastoni* Sharp may be taken as the type.

Key to the species

1. Third tarsal segment deeply emarginate distally, almost bilobed (fig. 1,d) 2
   Third tarsal segment truncate or but slightly emarginate distally (fig. 1,b,c) 3

2(1). Prothorax usually with a median impression near the base and one on each side, coarsely and rather unevenly punctate, the punctures often confluent; elytra strongly angulate on the sides at about the apical third; strial punctures large and coarse, often foveaform at the base; not over 5 mm. long..... **H. swezeyi.**

Prothorax evenly convex, with at most a feeble basal impression, finely and evenly punctate throughout; elytra constricted but not angulate on the sides at the apical third, strial punctures small, not at all foveaform at the base; black; usually 6-8 mm. long..... **H. filicum.**

3(1). Base of elytra not broader than base of prothorax; body subcylindrical..... **H. cylindricus**

Base of elytra distinctly and conspicuously broader than base of prothorax 4

4(3). Elytral intervals each bearing a single row of rather long hairlike setae, humeri rectangular or nearly so (fig. 1,a); less than 4 mm. long..... **H. kaalaae.**

Elytral intervals normally with two or more series of setae; humeri more or less rounded..... 5

5(4). Elytra strongly and abruptly angulate on the sides in the apical third, setae very conspicuous, of two types, one long, slender and erect, the other shorter, prostrate or inclined, the long, erect setae usually most conspicuous on the second, third and fifth intervals, on the disk, the other intervals usually without long, erect setae..... **H. hirtellus.**

Elytra constricted, but not angulate on the sides in the apical third; elytral setae short, not long and conspicuous; 6-8 mm. long 6

6(5). Third elytral interval not broader than second; elytral setae conspicuous throughout; prothorax not or but feebly margined at the base..... **H. foveatus.**

Third elytra interval about as broad as the first and second together; elytral setae minute and inconspicuous on the disk, but comparatively long and condensed near the apices of the intervals; prothorax with a distinct basal margin..... **H. wollastoni.**

1. **Heteramphus cylindricus** Sharp.

Breeds in the bases of the leaves and stems of *Astelia*. Mount Tantalus, Mount Olympus, and Mount Kaala. Figured in Fauna Hawaiiensis, vol. ii, pl. viii, figs. 9 and 10.

2. **Heteramphus filicum** Perkins.

Found on Mount Tantalus in rotting stumps of *Cibotium* and *Sadleria* ferns. Figured in Fauna Hawaiiensis, vol. ii, pl. viii, fig. 7.

3. **Heteramphus wollastoni** Sharp.

This species is usually found in *Astelia* but may occasionally be taken in rotten fern stumps. Mount Tantalus and Niu Ridge. Figured by Blackburn and Sharp, Royal Dublin Soc. Trans., ser. ii, pl. v, fig. 31, 1885.

4. **Heteramphus foveatus** Sharp.

Like the preceding species, this species may occasionally be found in rotting fern stumps, but is more often found in *Astelia*. Mount Konahuanui and Moanalua.

5. **Heteramphus kaalaae,** new species (fig. 1,a).

Derm shiny, somewhat transluscent, reddish-brown, the legs usually yellowish; setae yellow.

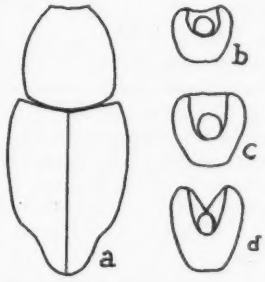

Fig. 1.—Outlines of Characters of *Heteramphus:* a, *H. kaalaae,* new species. b, c, d, third tarsal segments of: b, *H. hirtellus;* c, *H. foveatus;* d, *H. swezeyi.*

Head minutely punctate behind the eyes, interocular area more coarsely punctate, with a small interocular fovea; eyes very small, three to five facets broad, about two thirds as long as the breadth of the interocular area. *Rostrum* separated from the head by a very slight impression, gently arcuate, densely punctate, the punctures oval, close throughout, each bearing a minute, hardly discernible seta behind the antennae. *Antennae* inserted at slightly less than one third from the apex of the rostrum; first funicular segment as long as two plus three, two as long as three plus four, three longer than four, four to seven successively shorter and broader, seven slightly transverse; club as long as the preceding five segments, its first segment constituting half its length. *Prothorax* very slightly longer than broad (3.3:3.1), base slightly arcuate, not margined, broadest at about the basal third, thence roundly narrowing to the apex; disk with a variable impression just behind the middle, evenly, rather coarsely punctate throughout, the interstices between the punctures usually not as broad as the punctures, usually about half as broad; each puncture normally bearing a rather long, fine, decumbent seta. *Elytra* more than three fifths as broad as long (3.5:5), about twice as long as the prothorax; base broadly and distinctly emarginate, humeri conspicuously broader than the base of the prothorax, rectangular or nearly so, evenly narrowed and arcuate on the sides from the base to about the fourth ventrite, thence rather abruptly constricted, thence roundly narrowing to the apex; the post-humeral impression shallow but distinct; the striae well marked, their punctures small near the suture but becoming larger and closer toward the sides, the third and fourth usually joining before the base, the sixth beginning at a short distance from the base, the seventh beginning above the hind coxa; the intervals slightly convex, the first variable in breadth, one half to almost as broad as the second, the eighth forming the lateral margin above the epipleurae; each normally bearing a single row of rather long, conspicuous, inclined, hairlike setae borne from small punctures. *Legs* with the fore femora more strongly clavate than the others; all the tibiae with a sharp tooth at the inner apical angle, the fore pair with a distinct angulation between the inner apical angle and the middle and with denser yellow setae on the anterior surface in the distal half; tarsi with the second segment hardly broader than the first, the third slightly broader than the second, truncate or nearly so at the apex. *Sternum* with the prosternum with

small scattered punctures separated by distances greater than their diameters; meso- and metasternum with smaller scattered punctures. *Venter* minutely punctate throughout, the punctures bearing short, fine setae; the first two ventrites very slightly flattened in the middle in the male; the intercoxal process of the first ventrite arcuate. Length, 3-3.8 mm.; breadth 1.3-1.6 mm.

Oahu. Holotype, stored in Bishop Museum, and three paratypes sifted from moss collected from about the roots of a *Metrosideros* tree on the summit of Mount Kaala, March 28, 1937, and one paratype from moss on the ground at the same locality, June 25, 1937. All the specimens were collected by Mr. D. Anderson.

This is the smallest species of the genus thus far described. Its small size, pale coloration, angulate humeri, and its elytral intervals bearing single rows of conspicuous setae will readily distinguish this species. It resembles a diminutive *H. foveatus* but is readily separated from that species.

The sex of four of the specimens is rather uncertain. In rostral characters, all seem to be males. One specimen has the aedeagus protruding and has a characteristic male abdomen, the other three specimens have abdominal characters that are rather intermediate between the male and typical females of other species. The eyes of the male are broader than those of two of the other specimens.

6. **Heteramphus hirtellus** Sharp.

Three specimens in the Giffard collection at the Bishop Museum collected under decaying leaves on damp ground September 15 and 21, 1907 on Mount Tantalus and one specimen taken by E. Y. Hosaka in Kipapa Gulch, July 6, 1933, 2,800 ft., are evidently the only specimens of this species collected since Blackburn sifted the unique type from dead leaves.

7. **Heteramphus swezeyi** Perkins.

The larvae of this interesting species mine the sterile fronds of several species of *Elaphoglossum* ferns. Palolo Valley, Mount Olympus, Waialae-nui Ridge, and Punaluu.

Atelothrus on Oahu (Coleoptera, Carabidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of July 1, 1937)

The genus *Atelothrus* Sharp was known to occur on all of the main Hawaiian islands except Oahu at the time of the writing of the "Fauna Hawaiiensis". In 1917 (Ent. Mo. Mag. ser. 3, vol. 3, pp. 246-247, 1917) Dr. Perkins described two species from Oahu, and thus the gap in distribution was closed. There are now 19 described species in the genus which is confined to the Hawaiian islands. The

headquarters for the genus is the centrally located island of Maui where 10 described species occur. The others are distributed as follows: Kauai, 1; Oahu, 2; Molokai, 3; Lanai, 2; and Hawaii, 1.

Owing to the diligent researches of Mr. Swezey and others, a series of each of the Oahuan species have been collected and new data is presented herein.

The grooved hind tarsi, atrophied wings, and the single pair of prothoracic setae situated at the posterior angles readily place the following species in *Atelothrus*.

The two Oahuan species of *Atelothrus* may be readily separated by the characters given in the following key:

Derm very dark reddish brown throughout; with three large elytral foveae between the third and fourth striae, easily seen with the unaided eye, these striae often fused at the foveae.....**A. fractistriatus.**

Derm mostly pale yellowish-brown or brown with the head usually darker and in contrast with the paler pronotum and elytra; elytra without foveae between the third and fourth striae; the discal striae straight.....**A. metromenoides.**

Atelothrus fractistriatus Perkins (fig. 1 : b, d).

Derm very dark reddish-brown throughout, the legs and antennae not or but slightly paler.

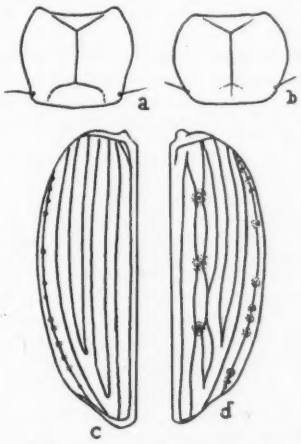

Fig. 1.—*Atelothrus* on Oahu: a, prothorax of *A. metromenoides;* b, prothorax of *A. fractistriatus;* c, elytron of *A. metromenoides;* d, elytron of *A. fractistriatus.*

Head with the labrum variable, one third to fully as broad as the clypeus. *Antennae* with the first three segments shiny, bare excepting a whorl of setae at the apex, segments 4-11 densely setose and more opaque. *Prothorax* one fourth broader than long, base and apex truncate, almost evenly arcuate on the sides, but slightly more narrowed behind than in front of the middle, base about as broad as the apex, the baso-lateral angles obtuse, well rounded;

disk not sculptured nor punctate, with the median line distinctly impressed, the anterior constriction distinct. *Elytra* elongate-oval, somewhat more than three times as long as the prothorax, about three fifths as broad as long; intervals nearly flat; first stria joining the second just behind the base, second and third joining in a conspicuous setigerous fovea at the basal third, middle and apical third, three joining four at a distance from, and terminating before, the apex, four usually, but not always, touching or confluent with three between the middle and posterior foveae, five and six joining at about the posterior fovea and not continued much beyond it, seven continued to the apex, eight with the setigerous foveae strongly developed and very conspicuous from near the base to apex. *Wings* hardly longer than the metanotum. *Legs* with the fourth tarsal segment deeply bilobed on the fore and middle pairs, the hind pair less deeply so than the fore pair. *Venter* with the fifth ventrite with three setigerous punctures on either side of the middle of the apical margin in the female. Length, 6 mm.; breadth, 2.5 mm.

Koolau Mountains: Mount Olympus, January and April; Mount Konohuanui, November; Kipapa Gulch, 2,800 ft., July.

This species can readily be distinguished from all others of the genus by the conspicuous elytral foveae which can easily be seen with the unaided eye.

The fusion of the fourth stria with the third between the middle and posterior foveae is subject to variation. One elytron may have them fused while on the other they may be separated. One specimen has these striae obsolete between the foveae.

Atelothrus metromenoides Perkins (fig. 1: a, c).

Derm pale brownish-yellow to yellowish-brown, with the eyes black, and the head infuscate and darker than the prothorax or elytra.

Head with the labrum and clypeus subequal in breadth. *Antennae* with the first three segments shiny, bare excepting a few long setae at the apices, segments 4-11 densely setose and slightly more opaque. *Prothorax* slightly broader than long, base and apex subequal in breadth, broadest in front of the middle, slightly narrowed and slightly concave on the sides behind the middle, baso-lateral angles obtuse, roundly angulate; disk not distinctly sculptured nor punctate, the median line, subbasal and subapical impressions distinct. *Elytra* ovate, somewhat more than three times as long as the prothorax, seven tenths as broad as long, moderately convex; striae shallow, straight and entire; intervals almost flat, the third without foveae, the setae arising from near or in the third stria, but with the puncture obsolete or nearly so; setigerous punctures of the eighth stria distinct but shallow. *Wings* narrow and but slightly longer than the metanotum. *Legs* with the fourth tarsal segment not very strongly bilobed, deeply emarginate. *Venter* with three setigerous punctures on either side of the middle of the hind margin of the fifth ventrite in the female, evidently but one in the male. Length, 6 mm.; breadth, 3 mm.

Waianae Mountains: Mount Kaala, February, March, April, July; from *Astelia;* evidently restricted to Mount Kaala.

The name of this species was well chosen. It so closely resembles *Metromenus mutabilis* (Blackburn) that the two species could easily be mixed in the same series if the prothoracic setae were overlooked. *M. mutabilis* is only known from the southern part of the Koolau Mountains from Moanalua, Lanihuli, Tantalus, and Wailupe. It has also been found in *Astelia.*

Emperoptera from Maui (Diptera, Dolichopodidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of September 2, 1937)

Heretofore, the aberrant, monotypic genus *Emperoptera* has been known to occur only on the island of Oahu. The genus was erected by Grimshaw in 1902 (Fauna Hawaiiensis, vol. III, p. 81) for the reception of a peculiar, flightless species collected by Dr. Perkins in the Koolau mountains. During a recent trip to Mount Haleakala on Maui, I collected a second species of the genus which I describe as new herein.

Unfortunately the nine specimens of the type series of *Emperoptera mirabilis* Grimshaw, the genotype, were in poor condition when Grimshaw drew up his descriptions. His descriptions are incomplete, and many important characters, especially in chaetotaxy, are omitted. Unfortunately it is not possible for me to substantially enlarge the descriptions of *E. mirabilis* because no complete specimens are at hand. In Bishop Museum there are three mounts from the original series, but two of these are fragmentary and not recognizable and the third is so mangled that many of the important morphological features are obliterated. Evidently no specimens of the species have been collected since Dr. Perkins was working here. Dr. F. X. Williams, who has made extensive and careful collections of Hawaiian Dolichopodidae, and I have made several trips to the type locality and have patiently and specially searched for this fly without success.

If one were to work entirely from the descriptions, he would possibly come to the conclusion that the Maui species belonged to a new genus, rather than to *Emperoptera*. Grimshaw did not describe the cephalic or thoracic setae, and he considered the halteres absent. After critically examining the specimens in Bishop Museum, I have reached the conclusion that halteres are present on *E. mirabilis*. On one of the specimens the halteres are represented by small stumps that may be only the bases of the stalks of halteres whose heads have been broken off. On the other hand, they may be entire but much atrophied. The former conclusion is the most probable, I believe, because on the new species the halteres are large and well developed, but if their heads were broken off similar stump-like structures would remain. An accurate discussion of the structures can only be given when fresh material of *E. mirabilis* is collected.

Twenty-four specimens of the new species were collected. Although many of the specimens, especially their heads, are distorted, owing to drying and the subsequent collapse of the body walls, several specimens are in perfect condition, and I took the precaution to preserve one specimen in alcohol. An accurate description of the

new species is therefore possible, and I have included both generic and specific characters in the description.

Emperoptera haleakalaae, new species (fig. 1).

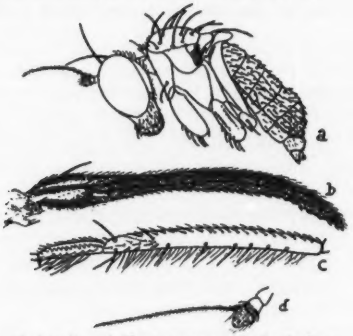

Fig. 1.—Diagrams of details of *Emperoptera haleakalaae*, new species, male; *a*, side view, tibiae and tarsi omitted; *b*, wing; *c*, tibia and first tarsal segment of middle leg; *d*, *antenna*.

Male

Head with the eyes black, somewhat diluted with red, occupying the entire sides of the head, extending from the top to the base of the rostrum, distinctly contiguous at about half way between the antennae and the rostrum, with short, fine hairs between the facets; epistome narrow, triangular, with short dense, greyish pile; labrum with similar pile and several conspicuous black bristles; medially emarginate; rostrum with rather numerous black bristles; frons finely reticulate, rather bronzy or greenish-brown, with iridescent reflections; vertex rounded, not sharp; ocelli in a triangle on a distinct, but low and rounded callosity, the distance between the posterior pair slightly less than the distance between either and the nearest point on the eye; bristles shiny black; greater ocellars very conspicuous, fully as long as the distance between the eyes across the ocellar triangle; the two lesser ocellars small and rather inconspicuous, not longer than the distance between the ocelli; the single vertical similar in size to the greater ocellars; with a row of conspicuous posterior orbital bristles; otherwise without bristles. *Antennae* with the first two segments yellow; second with a whorl of stout black setae near the apex; third segment infuscate, almost black, clothed with rather dense, fine hair, sub-triangular, somewhat larger than the second; arista slightly longer than the greater ocellar bristles, very slender, evenly and densely clothed with fine, short hair throughout. *Thorax* finely reticulate, pleurae yellow or but slightly infuscate, notum concolorous, bronzy-brown with slight iridescent reflections; scutellum not quite twice as broad as long, arcuate behind; without hair, bristles stout, shiny black; pronotum with a row of comparatively long, fine bristles projecting over the neck; mesonotum with numerous, very small, inconspicuous setae on its anterior face above the pronotum, with one long, one short and one very short humeral, one long posthumeral, two notopleurals, the anterior one fully twice as long as the posterior, one long supraalar, one similar postalar together with the posterior dorsocentrals making a prescutellar row of four long

similar bristles, with the postalars slightly longer, with two similar anterior dorsocentrals on either side, the longitudinal distance between them about three fourths that between the second anterior dorsocentral and the posterior dorsocentral, the second anterior dorsocentral longer than the other dorsal bristles excepting the two long, usually decussate, posterior, marginal scutellars, scutellum otherwise with two small inconspicuous bristles between, and one similar bristle on each side of the major scutellars; propleura with a single propleural bristle projecting well below the base of the front coxa; pleurae otherwise without distinct bristles. *Wings* reduced to narrow, falciform, infuscate, densely setose appendages, about as long as the hind tibia plus the first tarsal segment and, at the middle, hardly as broad as the scutellum; with three strong veins at the base; with a prominent bristle, longer than the greatest breadth of the wing, arising from the costa at a short distance from its base; axillary process with two small bristles. *Halteres* yellow, strongly developed, the club ovate. *Abdomen* colored as the mesonotum; metanotum forming a carina around the anterior and lateral margins of the first tergite; rather densely set throughout with scattered black bristles, but without hair. *Legs* with the fore and hind coxae yellow, the fore coxae paler, the mid coxae yellow but slightly infuscate; fore and mid coxae with conspicuous black bristles on the inner sides, those on the lower inner edge of the fore pair largest, mesocoxae shallowly caniculate externally, metacoxa with a conspicuous bristle at about the middle on the outer side near the trochanter, and a long one at the anterior apical angle; trocanters with a few small setae; femora yellow but usually somewhat infuscate, rather densely clothed with black bristles, with one or two longer bristles near the apex, the hind pair with a particularly conspicuous long bristle on the outer side at a short distance from the apex, middle pair with several long bristles on the inner lower edge near the base; tibiae yellow but infuscated, the anterior pair usually slightly paler; length of tibiae as, fore 30, middle 50, and hind 65; fore pair with short black bristles and no long ones, hind pair with a variable number of long bristles in addition to the short ones, often eight or ten but frequently fewer owing to abrasion, middle pair with the bristles short on the posterior edge but otherwise more numerous and much longer at the apex and on the anterior side; tarsi yellow but infuscate; the fore pair with short bristles throughout, the segments 20, 10, 7, 5, 5 in length; middle pair with short bristles as the fore pair but with the first segment with long bristles on the outer side and a distinct tooth at its outer apical angle, the segments 24, 24, 20, 7, 5; hind pair with short bristles throughout as the fore pair, the segments 15, 19, 13, 8, 6. Length of body, 1.52 mm.

Female

Similar to the male in most details excepting the terminalia, but with the eyes not absolutely contiguous but separated at the middle by almost the diameter of a facet, the separation pilose; the middle tibiae rather similar to the hind pair in chaetotaxy and without long, dense bristles on the anterior edge; first segment of the middle tarsi not modified as in the male.

Maui, Hawaiian islands. Holotype male, allotype female in B. P. Bishop Museum, 16 males and three female paratypes and two decapitated males collected by me on the northwest slope of Mt. Haleakala, 6,000-6,500 feet, August 18, 1937, and one male from the Kula pipe line trail in the forest near Olinda at 4,000 feet, August 20, collected in alcohol and dissected. These localities are not far from one another; the locality of greater elevation being above Olinda and reached by the new road to the summit of Haleakala,

taking off down the slope to the northeast of Puu Nianiau to the margin of the forest below the upper grazing land.

This species differs from *Emperoptera mirabilis* principally as follows: the derm of the dorsum is dull and reticulate, somewhat bronze with iridescent reflections; it is, for the most part, shining dark brown or black in *E. mirabilis;* the wings are somewhat narrower and there is no long bristle at the apex. The specimens of *E. mirabilis* before me are too fragmentary for further accurate comparison.

The individuals of this species range over the moss and lichen covered trunks and branches of living and dead trees, on fallen logs and on the ground in the damp forest. They are active and will jump one and one half to two inches at the slightest provocation. Their small size and cryptic coloration makes them difficult to find. The only specimens I saw were those I captured and a search of their habitat failed to disclose them running about undisturbed. They were collected by beating moss and lichen covered limbs or trunks, by tearing off moss and lichens and shaking the material into a beating net and by throwing ground litter on a piece of white sheeting and watching carefully until they began to hop or run about. They are easily recognized in the field owing to their peculiar, atrophied wings being held horizontally at about right angles to the body and by their habit of jumping once or several times in succession as they run about.

Idotasia in New Ireland (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of September 2, 1937)

Heretofore, the cryptorhynchine genus *Idotasia* Pascoe has not been recorded from New Ireland. The data offered in this paper fill another gap in the chain of distribution of the genus.

I take much pleasure in dedicating the following new species to Mr. C. E. Pemberton, as a slight token of appreciation for his many favors and kind cooperation in the past.

Idotasia pembertoni, new species (fig. 1).

Male. Derm uniformly shiny black with the antennae reddish-brown; scaling and setae white.

Head flattened above; densely and comparatively coarsely punctate, the punctures bearing short setae, without an interocular fovea; eyes hardly more than half as broad as the interocular area. *Rostrum* rather evenly arcuate from base to apex below, continuous with the dorsal outline of the head at the base above to about half way between the eye and the insertion of the antennae and then abruptly bent downward, strongly convex from the base almost to the antennae and then straight to the apex; with three strong dorsal carinae from the base to beyond the antennae, the lateral ones extend-

ing to the apex; sulci between the carinae coarsely punctate and bearing numerous, rather short, erect or inclined setae. *Antennae* with the scape hardly longer than the first two funicular segments; first funicular segment slightly shorter and not distinctly bulkier than the second which is as long as three plus four, segments four to seven successively more transverse and bulkier; club compressed, slightly longer than the three preceding segments. *Prothorax* slightly broader than long, almost straight on the sides from the shallowly sinuous base to beyond the middle and thence broadly rounded to the apex, dorsal contour evenly convex; densely and evenly set with round, medium-sized punctures separated by interstices equal to about one-half their diameters, somewhat more coarsely and closely punctate on the sides but with the posterior concavity for the reception of the femora for the most part smooth and impunctate; the punctures bearing minute, hardly discernible setae. *Elytra* sub-cuneiform, three fifths as broad as long, slightly more than twice as long as the prothorax; base rather strongly, but broadly bisinuate, the humeri slightly embracing the posterior angles of the prothorax, broadest slightly behind the base and thence evenly and straightly narrowed to the rounded apex; suture slightly grooved; the discal striae obsolete, marked only by rows of small or minute, shallow, widely spaced, often indistinct punctures in the basal half, the fifth stria distinctly but shallowly impressed,

Fig. 1.—Outline of head and rostrum of *Idotasia pembertoni*, new species, with detail of prothoracic punctuation.

the sixth and outer striae variable and irregularly impressed between the punctures; the intervals each with a row of minute punctures bearing microscopical setae, the fourth and fifth with an elongate patch of condensed setiform squamae near the apex of the elytra. *Legs* with the femora rather densely punctate, the punctures bearing prostrate setae, the mid and hind pair densely clothed with setiform scales along the upper edge, deeply grooved, the groove bearing a carina near its external margin, edentate; tibiae rather strongly carinate, the uncus strong, with numerous slender or hairlike erect setae. *Sternum* with the mesosternal receptacle projecting to a level only about half the depth of a metacoxa from the metasternum to the trochanter, with a large fovea on either side of the median line behind; metasternum concave, about one-half as long as the first ventrite, deeply, broadly, triangularly emarginate behind, with deep, setigerous punctures on either side; the metacoxae clothed on the inner sides with a large, dense, spongy mass of slender setae. *Venter* with the first two ventrites deeply and broadly concave, with scattered punctures down the middle bearing fine setae and with coarser, denser punctures bearing broader and longer setae at the sides, the first about two-fifths longer than the second; the metacoxa bearing a tuft of long setae at the edge of the first; fifth ventrite fully a third longer than three plus four, with a few setigerous punctures at the sides, broadly concave down the middle and rather densely set with setigerous punctures on the sides and behind. Length, 5 mm.; breadth, 2.4 mm.

New Ireland. Holotype male and one male paratype, in B. P. Bishop Museum, collected by Mr. Pemberton in April 1937, at Kandan village.

This fine species may be readily distinguished by its flattened head and rostral structure in combination with its shiny black derm and densely and evenly punctate pronotum.

The Status of Acalles wilkesii (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of October 7, 1937)

In "Insects of Hawaii, Johnston and Wake Island" (Bishop Mus. Bull. 31, 1926), Dr. Perkins described a small cryptorhynchine weevil under the name of *Acalles wilkesii* from Wake Island. I have had occasion to study the only known specimens (type and paratype) of this species and find that an error has been made in placing the species in *Acalles*. It is a typical, unspecialized species of *Microcryptorhynchus*. I have described a large number of *Microcryptorhynchus* from many islands in the south Pacific and am certain of my conclusions. The specimens of *Acalles wilkesii* differ from the genotype of *Microcryptorhynchus* before me in specific characters only. In fact, the two species are quite similar in general structure, but *M. pygmaeus*, the genotype, is darker in color, slightly stouter and has setae on all of the elytral intervals. There is no doubt whatsoever that the two species are congeneric. The majority of the Pacific *Acalles* are larger insects with tuberculate or otherwise modified elytra and prothoraces, their tibiae are usually carinate, the abdomen usually has the ventrites somewhat offset, the mesosternal receptacle is much heavier, very strongly protuberant, and the pectoral canal terminates between the fore and mid coxae. In none of the Pacific species known to me do the elytra and legs bear the type of conspicuous setae exhibited by this species that is so characteristic of *Microcryptorhynchus* (excepting, perhaps, some of the New Zealand species which are in dubious positions as they now stand in *Acalles*).

The recording of *Microcryptorhynchus* from Wake Island is of considerable importance in the study of the geographical distribution of the genus. In so far as we know, Wake Island is the most northern limit of its range and may be its absolute limit. This island is about as far north as Hawaii, but for some reason yet unexplained *Microcryptorhynchus* has not reached the Hawaiian Archipelago. Had the genus become established in Hawaii, it would probably be quite as complexly developed there as *Proterhinus* and perhaps even more so. With this record we now know that the genus is distributed throughout an enormous area of the Pacific from Henderson Island in the east to the southeastern tip of Australia in the south,

to Guam in the west and Wake Island in the north. This is also the first record of the genus being found on a low, coral atoll. I found a species on Henderson Island which is a coral island, but it is elevated and is densely forested like a volcanic island.

Owing to the magnitude of the original description, which does not include a number of important characters that are being used in contemporary descriptions and keys for specific separation, I redescribe the species as follows:

Microcryptorhynchus wilkesii (Perkins), new combination.

Acalles wilkesii Perkins: Bishop Mus. Bull. 31, pp. 63-64, 1926.

Female. Derm reddish-brown, covered with a rather thick, comparatively loose, pale, yellowish or whitish incrustation; scaling and setae white.

Head concealed from above by the pronotum; coarsely reticulate, finely punctate, rather closely squamose, the squamae concave, their edges somewhat farinaceous; with a row of rather long, slender, narrowly lanceolate, erect setae along the inner margins of the eyes, sometimes with a few setae suggesting a second inner row near the base of the rostrum. *Rostrum* squamose at the base only and bare and shining from behind the antennae to the apex in the female, with four shallow, dorsal striae near the base, but not carinate, the strial punctures giving rise to fine erect setae, those at the base stouter; finely and serially punctate beyond the antennae. *Antennae* with the scape about as long as the first four funicular segments; the first funicular segment much stouter than the others and longer than the next two together, the second and third segments sometimes closely articulated and giving the appearance of one segment, and, therefore, a six segmented funicle, but the funicle is truly seven segmented. *Prothorax* slightly longer than broad (3:2.75), rounded on the sides from the base to beyond the middle and thence distinctly constricted, the constriction continuing shallowly across the dorsum which is otherwise slightly convex; base subtruncate, the squamose area higher in the middle than on the sides, densely punctate throughout, the interstices reticulate, not broader than the punctures; normally with small, thin squamae capping the punctures; the setae narrowly lanceolate, erect, scattered on the disk, more numerous at the apex. *Elytra* elongate-oval, two thirds as broad as long, twice as long as the prothorax, base very slightly emarginate, almost truncate, evenly arcuate on the sides from the base almost to the apex and there with a slight subapical constriction; striae about as broad as the intervals, the punctures shallow; the intervals normally with small, thin squamae, only the alternate intervals setose, the setae long, erect, slender, sharp and spike-like, shorter on the disk and becoming longer toward the apex. *Legs* with thin squamae and bristling with rather long setae. *Sternum* with the mesosternal receptacle cavernous, with thin side walls that project forward to the fore coxae, the hind wall thin and hardly protuberant, terminating at the posterior margins of the mesocoxae in the female; metasternum reticulate, finely punctate, the punctures bearing arcuate setae, about as long as a metacoxa at its narrowest point between the mid and hind coxae. *Venter* coarsely reticulate, set with small, scattered, setigerous punctures, all the ventrites bearing setae; the first two ventrites convex, but flattened in the middle. Length, 1.6 mm.; breadth, 0.7 mm.

Wake Island. Type and paratype (females) collected from *Sida* on Wilkes Islet by E. H. Bryan, Jr., July 27, 1923.

In body form this species somewhat resembles *M. analis* Marshall, from Samoa. *M. analis*, however, is a much more coarsely sculptured species.

A Key to the Genera of Hawaiian Anthribidae (Coleoptera)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of November 4, 1937)

Although conditions in Hawaii seem favorable for the development of Anthribidae, only five genera are known to occur here. None of these is endemic. Only one genus, *Araecerus,* has developed endemic species in the islands; the other four genera are each represented by single, widely spread, rather recently introduced species. This paucity is surprising, considering the great tracts of tropical forest on the islands. The transportation agents of distribution have for some reason almost entirely excluded this family from Hawaii.

Araecerus is represented by three species: *A. fasciculatus* (De Geer), *A. vieillardi* (Montrouzier), and *A. constans* Perkins. The first two species are widely distributed in the Pacific; the third is the only described endemic Hawaiian species in the family. Much confusion has arisen because of the misidentification of the Hawaiian members of this genus. In the original series for the "Fauna Hawaiiensis" several distinct species have been lumped together under the name *A. fasciculatus.* These species are new and may still be found in most collections confused with *A. fasciculatus.* A revision of the Hawaiian members of the genus is forthcoming.

KEY TO THE GENERA[1]

1. Eyes conspicuously and deeply emarginate below 2
   Eyes entire, not at all emarginate 3

2(1). Length 7-10 mm.; interocular area much narrower at the apex than the breadth of an eye; first foretarsal segment not much longer than segments two plus three ..... **Phloeobius gigas horeus** Jordan.
   Length less than 5 mm.; apex of the interocular area as broad or broader than an eye; first foretarsal segment fully as long as segments two, three, and four together ..... **Exillus lepidus** Jordan.

3(1). Lateral prothoracic carina extending from base to apex; antennae fully as long or much longer than the body, inserted on the front of the head near the upper corners of the eyes ..... **Proscopus veitchi** Jordan.
   Lateral carina of the prothorax not reaching the apex; antennae always much shorter than the body, inserted on the rostrum beneath the eyes 4

4(3). Interscrobal area slightly broader than the interocular area; second antennal segment clavate, as long or slightly longer than either the first or third segments; lateral prothoracic carina extending beyond the middle to almost two thirds the distance from base to apex ..... **Mauia subnotatus** (Boheman).
   Interscrobal area narrower than the interocular area; second antennal segment subovate, shorter than either the first or third segments; lateral prothoracic carina not extending past the middle. ..... **Araecerus.**

[1] This key was revised after the author found *Proscopus veitchi* Jordan in Honolulu in March 1938. See the next number of these Proceedings for details.

A Key to the Lanaian Proterhinus (Coleoptera, Aglycyderidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of November 4, 1937)

Of all the genera of Hawaiian insects probably none surpasses *Proterhinus* in taxonomic difficulties. No keys have been prepared to aid in the separation of the species described in the "Fauna Hawaiiensis" or subsequently, and, therefore, it is an almost impossible task for anyone not having access to collections named by Dr. Perkins to determine his material. There are about 175 species and varieties described from our islands. The intergradations of characters between these species is remarkable; a more plastic group of insects can hardly be found.

I herewith present my first attempt of keying out the *Proterhinus* of Lanai. I began with Lanai for the reason that it has had fewer species (16) recorded from it than any of the other main islands, and because it is the only island from which we have a complete collection in Hawaii. The difficulties encountered in making this key were so great that I fear that a complete set of keys to the species of all the islands will be a long, discouraging task, if not an impossible one, without a complete revision of the family. However, if the named species are true species, they can be keyed.

Some of the Lanaian *Proterhinus* are quite distinct and readily recognized. However, major difficulties present themselves beginning especially with dichotomy 12 and continuing to the end of the key, for the species contained in that part are closely allied and present few or no salient characters to aid in their separation.

1. Second antennal segment distinctly shorter than the third 2
   Second antennal segment approximately as long as the third, not conspicuously shorter 8
2. Eighth antennal segment distinctly longer than the ninth ..... **P. longicornis** Sharp
   Eighth antennal segment shorter than the ninth, or at least not distinctly longer 3
3(2). First antennal segment long and stout, distinctly longer than segments two plus three ..... **P. insignis** Sharp
   First antennal segment distinctly shorter than the following two segments together 4
4(3). Elytra with distinct callosities or with callosities and rather large, distinct impressions, the dorsum irregular; prothorax rather or distinctly strongly gibbous at the base 5
   Elytra with the dorsum rather even, not interrupted by large callosities nor large depressions; base of prothorax not or hardly gibbous 6
5(4). Prothorax very strongly gibbous at the base, the median line distinctly impressed on the basal gibbose area; the three large impressions confluent; humeri rather strongly projecting around the basal angles of the prothorax; elytra with a common trans-

verse scutellar callous and a single large, broad callous on each elytron between the base and the middle.....**P. alyxiae pauper** Perkins

Prothorax with the median line not impressed on the gibbous area which gradually slants forward and is not very steep on its anterior face, the two lateral impressions smaller, deeper, better defined than the median one, not at all confluent with it; humeri angulate and prominent but not tending to strongly embrace the posterior angles of the prothorax; elytra with several irregular impressions on either side of the suture between longitudinal and less conspicuous, transverse calli from behind the scutellar callous to the declivity.....**P. dispar** Sharp

6(4). Head with a distinct, low, rounded, arcuate ridge between the posterior margins of the eyes.....**P. lanaiensis** Perkins

Head without a distinct ridge between the posterior margins of the eyes 7

7(6). Subapical constriction of the prothorax strongly impressed, making the sides distinctly and sharply angulate at the hind margin of the constriction; elytra sparsely set with golden setae, without large patches of pale, dense setae; humeri not produced around the basal angles of the prothorax; a drab reddish species.....**P. detritus** Sharp

Subapical constriction of the prothorax broadly and concavely impressed, the sides not at all angulate at the base of the constriction; elytra densely clothed with pale, golden, prostrate setae with scattered bare patches; humeri prominent, sharply pointed, distinctly projecting forward around the base of the prothorax.....**P. ineptus** Sharp

8(1). Humeri prominent or very prominent, strongly angulate, produced into pointed processes that usually project prominently around the basal angles of the prothorax..... 9

Humeri more or less rounded off or roundly angulate, never produced into sharp processes and never prominently produced around the base of the prothorax..... 11

9(8). Pronotum with long, slender, straight, sharp-pointed, erect, scattered setae in addition to the short, curved, recumbent setae; elytra bristling with even longer setae; a very "spiny" species .....**P. blackburni** Sharp

Pronotum with only short, curved, prostrate setae throughout.... 10

10(9). Head with a distinct, low, arcuate ridge between the hind margin of the eyes; elytra with a callous on either side of the scutellum more densely clothed with pale setae, making a distinct pale spot on either side of the scutellum visible to the unaided eye; elytra usually with several irregular discal callosities..... .....**P. innotabilis** Perkins

Head without a ridge between the eyes; elytra without distinct calli and without pale spots on either side of the scutellum, the fourth and fifth intervals usually conjointly somewhat more elevated than the others and making a characteristic raised line from near the humerus caudad, with the short prostrate setae sparsely scattered and not condensed into distinct pale patches; an elongate reddish species with subparallel-sided elytra.....**P. epitretus** Perkins

11(8). Elytra with a distinct, common scutellar callosity; prothorax rather conspicuously gibbous at the base, large, almost straightly and strongly expanded on the sides from the base to well beyond the middle, thence abruptly and strongly constricted before the apex.....**P. breviformis** Perkins

Elytra without a conspicuous scutellar callosity; prothorax not distinctly gibbous at the base, rather arcuate on the sides..... 12

12(11). At least the anterior pronotal fovea deep and distinct, distinctly limited and not simply a broad, indefinite, subapical depression.....**P. subangularis** Perkins

Pronotal foveae obsolete or nearly so, the lateral ones almost entirely wanting, the anterior fovea transformed into a broad, rather shallow, indefinitely formed, transverse subapical depression 13

13(12). Male with the first antennal segment stout and subtriangular, second segment short, somewhat quadrate, parallel-sided, the sides almost straight, almost or quite truncate at base and apex; these characters similar or with slight variations in the female.....**P. navita** Perkins

Second antennal segment more or less elongate-oval, never subquadrate, not parallel-sided, the base narrower than the apex which is distinctly rounded and the sides arcuate in both sexes 14

14(13). Pronotal setae scattered and comparatively sparse throughout, not condensed at the sides to form conspicuous patches of overlapping setae; antennae mostly very dark brown to black, basal one to three segments usually, but not always paler..... .....**P. analcis** Perkins

Pronotal setae denser, not evenly scattered throughout but condensed at the sides and there overlapping to form conspicuous, densely setose patches that appear as pale areas under low power; prothorax strongly rounded on the sides; antennae usually predominantly reddish..... 15

15(14). **P. epichlorus** Perkins

P. deceptor Perkins. No characters could be found on the specimens in the "Fauna Hawaiiensis" series in Bishop Museum to separate these two species. Until the types can be examined, or these species proven distinct on Lanai, it is best, I believe, to place the Lanai specimens running to this couplet under *P. epichlorus* Perkins.

A Second Species of Elytroteinus (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of December 3, 1937)

The cryptorhynchine genus *Elytroteinus* was erected by Sir Guy A. K. Marshall in 1920 to replace *Pteroporus* Fairmaire which was preoccupied by *Pteroporus* Schoenherr. Heretofore, only the genotype, *Elytroteinus subtruncatus* (Fairmaire) Marshall, has been described. That species has an extensive distribution in the Pacific from Fiji eastward and is of some economic importance.[1] Because of the wide distribution of *E. subtruncatus* and the fact that it has been carried by man from island to island in various cargoes, it has been difficult to assign the genus as endemic to a particular region.

[1] See Zimmerman, E. C., Cryptorhynchinae of the Society Islands, Bishop Museum Occ. Papers, vol. 12, no. 23, p. 10, 1936.

With the data supplied herein, we can now refer the genus to the Austro-Malayan subregion with more certainty.

Elytroteinus recticollis, new species.

Female. Derm black, for the most part dull, squamae and setae brownish yellow.

Head with a rather broad sulcus beginning at the base of the rostrum and continuing dorsally along the inner margin of the eye and extending on the crown for a distance about equal to half the distance between the eyes; with a rather large, irregular median fovea just above the dorsal margins of the eyes and with a vague, incomplete, median carina above the fovea; densely, shallowly, subconfluently punctate, the punctures rather large; with numerous, small, oval scales but without conspicuous erect setae. *Rostrum* with a lateral sulcus above the scrobe continuous with the lateral sulcus of the head and terminating slightly beyond the insertion of the antennae, without carinae, coarsely, densely, shallowly, subconfluently punctate from the base to the insertion of the antennae, the punctures there becoming rapidly smaller and distinctly separated, those near the apex minute; smoother and distinctly more shiny beyond the antennae than in the basal half; the punctures bearing short, fine, inconspicuous setae. *Antennae* inserted midway between the lower margin of the eyes and the apex of the rostrum; scape rather slender, as long as the seven funicular segments; first funicular segment slightly longer than the second, second as long as three plus four, four to seven successively slightly broader; club finely and densely pilose throughout, as long as the preceding four segments, four-segmented, the first segment making up half its bulk. *Prothorax* broader than long (*2*:1.75), base distinctly sinuous, slightly and straightly expanded on the sides in the basal two thirds, thence almost evenly rounded to the apical margin, but with a slight subapical constriction, the apical margin almost truncate above, dorsum but slightly convex, comparatively flat, the sides straight from the coxa to the dorsum when viewed from the front, with a shallow emargination at the base of the postocular lobe; dorsum densely set with rather large, shallow, separated, subconfluent and confluent punctures and with a narrow, irregular, incomplete median line; each puncture usually bearing a rounded, convex, prostrate scale; discal setae minute and inconspicuous, those at the apex slightly longer but not conspicuous; pleurae much more coarsely and irregularly and indefinitely punctate than the dorsum. *Elytra* five sevenths as broad as long, two and one third times as long as the prothorax; base bisinuate, rather angulately expanded on the sides from the base of the pronotum and thence irregularly narrowed to the broadly rounded apex; striae shallow, almost or quite impunctate; intervals with irregular, variable callosities as follows: the first three with a slightly raised callosity just before the middle, these, with an adjoining one on the fourth, making a more or less sublunate row, the concave side toward the base, the fourth with a slight callosity before and behind the submedian one, the third with a large subapical callosity fused with a similar callosity on the second and a smaller one on the fourth, the fifth interval with a callosity before and behind the sublunate row across the first to the fourth intervals and with an irregular callosity between the postmedian and subapical callosities on the fourth that extends laterally partially on the fourth and sixth, the sixth with three irregular callosities within about the basal half, seventh and eighth with a few irregular callosities; each callosity with the scales and setae condensed on it, but not very dense, the intervals otherwise almost devoid of setae and with two or three rows of rather scattered, depressed squamae; each interval with small tubercles, usually in single rows but more numerous near the base and on the callosities. *Legs* with the femora rather bluntly toothed; coarsely, densely, subconfluently punctate, the punctures bearing fine,

slanting setae or elongate scales; tibiae with three or four longitudinal carinae on either side, with small tubercles along the dorsal margin, uncus almost straight and arising near the inner apical angle. *Sternum* with the mesosternal receptacle deep, the walls very heavy, its inner margin terminating at the fore margin of the mesocoxae; fore and mid coxae coarsely punctate; metasternum coarsely punctate, only about one third as broad as a metacoxa at its narrowest point between the mid and hind coxae. *Venter* with the first two ventrites on a lower plane than the last three, convex but with the first somewhat flattened between the coxae, the second impressed on either side of the middle behind, the first with large, round, conspicuous punctures bearing short, fine setae, the second with inconspicuous punctures and rather similar setae; the intercoxal process of the first ventrite about twice as broad as a metacoxa and but slightly arcuate; fifth ventrite about one third longer than three plus four, inconspicuously punctate. Length, 7 mm.; breadth, 3.5 mm.

Auki, Solomon Islands. Holotype, a female collected by Dr. W. M. Mann, to be placed in the Museum of Comparative Zoology at Harvard College, whence it was sent to me for study through the courtesy of Mr. P. J. Darlington.

This species may be easily separated from *Elytroteinus subtruncatus* as follows: the prothorax of this species is densely and conspicuously punctate, and the sides are straight in the basal two thirds, whereas on the genotype the disk is at most minutely and indistinctly punctate, the sides are more rounded and the disk is more convex; the squamae on *E. subtruncatus* are much more numerous, longer, slanting and subsetiform, instead of small, rounded or oval and depressed; the elytral callosities on this species are more numerous, differently shaped and arranged than on the genotype.

The low callosities on the elytra are somewhat variable and may show considerable variation on the individuals of a series of specimens.

Teleodactylus in the Solomon Islands (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of July 1, 1937)

The cryptorhynchine genus Teleodactylus was erected in 1931 for a single Samoan species by Sir Guy Marshall (Insects of Samoa, pt. 4, fasc. 5, p. 294). Recently I recorded five species from Fiji (B. P. Bishop Mus. Occ. Papers, vol. 13, no. 7, May 1937). It is now possible to show that the genus also inhabits the Solomons.

This paper has been written not merely to describe a new species, which, unfortunately, is represented by a unique specimen, but rather to enlarge our knowledge of the geographical distribution of an interesting genus.

Teleodactylus is an ally of *Deretiosus* and can be distinguished from that genus by the fact that it has only six segments in the funicle of the antennae instead of seven and by its peculiar and diagnostic third tarsal segment which is truncate distally and not bilobed. The fourth tarsal segment is articulated in a dorsal fovea in the third segment.

Teleodactylus solomonae, new species.

Male. Derm reddish-brown, concealed by dense scaling; head with fawn-colored scales; scaling on the rostrum yellowish-white; prothorax with white scaling on the sides, predominantly fawn-colored on the sides of the disk, disk with a large, sub-circular, dark brown, median area from the base to the subapical constriction, with two small patches of similarly colored scales on either side of the median line at the apex; elytra with the scaling predominantly fawn-colored, variegated with patches of white and black or very dark brown scales, base with white scales forming a narrow transverse patch on either side of the scutellum extending over the second, third, and fourth intervals, with a conspicuous, slightly oblique, longitudinal black stripe beginning slightly before the middle on the second interval and terminating at about the apical third on the fourth interval, irregularly outlined externally with patches of white scales, with a less conspicuous, rather irregular, slightly oblique, transverse black fascia between the basal third and base beginning at the callosity on the third interval and extending to the sixth or seventh interval, with some irregular black patches on the sides behind this and an irregular black patch on the sides at the declivity extending irregularly from the lateral margin to the fourth or third intervals; scaling on the legs white to fawn-colored with some darker scales on the outer sides of the tibiae and hind femora; scaling below almost white.

Head shining, densely set with distinct, rounded punctures, their interstices hardly more than one half as broad as their diameters; the derm almost completely concealed by the very dense, spongy scaling; interocular area depressed, with one or two large, stout, erect setae at the inner margins of the eyes. *Rostrum* very densely squamose to the epistome, the derm entirely concealed except a very fine median carina which shows through the scaling as a fine line; with a single row of large robust setae at the base, with two lateral rows of smaller setae, continuous with those at base, from slightly behind the middle to near the antennae and with numerous short setae about the insertion of the antennae. *Antennae* with the scape no longer than the six-segmented funicle; first funicular segment about as long as the second but much more robust, almost as broad as the broadest part of the scape, second segment slender, as long as three plus four, three to seven successively stouter and more transverse; club as long as the preceding four funicular segments. *Prothorax* slightly broader than long (2.25:2), base slightly sinuous, slightly arcuate on the sides from the base to slightly beyond the middle, the subapical constriction distinct but not strongly developed; densely and rather coarsely punctate, the punctures moderately large, rounded or oval and separated by distances equal to about one half their diameters; without fasicles, the setae single, stout and subtubular, numerous and scattered on either side of the median line at the apex in front of the subapical constriction, and scattered on either side of the median line behind the subapical constriction on the dark discal area, with two situated on either side of the middle on the posterior margin of the subapical constriction the largest, with one stout seta arising from a more or less conical cluster of scales on the side at the posterior margin of the subapical constriction and another between this and the base, sometimes with a smaller seta between these two; with two or three setae

near the subapical constriction between the lateral ones and the dark discal patch. *Scutellum* protuberant, conical, its scaling rather dark. *Elytra* three fifths as broad as long, about two and one half times as long as the prothorax; base slightly sinuous; subparallel-sided from the base to about the apical third and thence rounded to the apex; with a feeble callosity on the third interval behind the base, otherwise without callosities; striae with deep rounded punctures concealed by the scaling, appearing as narrow lines where the scaling is not abraded; intervals broader than the striae, only the alternate intervals with setae, the setae erect, very broad and stout, striated, subtubular or spatulate, arranged singly except on the callosity on the third interval and there two abreast; the scales not forming distinct pustules around the bases of the setae. *Legs* with the femora and tibiae densely squamose, the densely punctate derm concealed by the scaling, with short, scattered, erect setae; the femoral tooth narrow and very sharp. *Sternum* densely squamose, the metasternum almost vertical between the mesocoxae and not tending to overhang. *Venter* densely squamose, the intercoxal process arcuate or slightly angulate in front; the first ventrite broadly emarginate behind, with deep, coarse punctures along the anterior margin, elsewhere minutely punctate. Length, 2.8 mm.; breadth, 1.3 mm.

Solomon Islands, Three Sisters (also known as Las Tres Marias or Olumalau). Holotype male collected by Dr. W. M. Mann to be deposited in the Museum of Comparative Zoology, Harvard College at Cambridge, Massachusetts, from whence it was sent to me for study.

This small species is not closely allied to any of the other described species. Its color pattern, lack of pronotal fasicles, lack of elytral pustules and its single pair of elytral callosities will serve to distinguish it.

Four New Solomon and Caroline Island Deretiosus (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of August 5, 1937)

No members of the cryptorhynchine genus *Deretiosus* Pascoe have heretofore been described from either the Solomon or Caroline Islands. Herein I describe three new species from the Solomons and one from the Carolines.

The material on which this paper is based was sent to me for study from the Museum of Comparative Zoology at Harvard College, Cambridge, Mass., through the kindness of Mr. P. J. Darlington.

Deretiosus fasciatus, new species.

Male. Derm reddish-brown throughout, hidden by the dense scaling; head and rostrum with brownish-yellow scales; prothorax pale brownish-yellow excepting a large, conspicuous, hemispherical area of dark brown scales

that has its base at the base of the prothorax, its apex at the hind margin of the median fascicles, and extends laterally along the base to the outer edge of the fourth elytral interval; elytra basically brownish-yellow, with a very conspicuous, broad, V-shaped band of dark brown scales beginning at the suture just in front of the basal third at the top of the declivity and extending obliquely to the tenth interval on the sides, slightly less than one third as broad, at the suture, as the length of the elytra, but expanding laterally and slightly more than one third as broad as the length of the elytra at the sides, the posterior margin terminating on the tenth interval at a point slightly behind the middle of the first ventrite, the anterior margin touching the hind edge of the humeral callus and terminating near the base of the elytra; interval two with dark brown scales at the base, the patch thus formed coalescent with a conspicuous dark brown patch behind the middle of the elongate fascicle on the third interval, the patches thus formed making a conspicuous, slightly oblique, dark brown patch on either side of the scutellar area; interval one with a few dark brown scales near the base; the elytra otherwise almost evenly brownish-yellow; legs and venter about the same color as the brownish-yellow background of the elytra.

Head shallowly concave between the eyes; with very dense concave scales and with numerous short spatulate setae across the forehead that project but little above the scaling and with several longer setae in a row along the inner margin of the eye. *Rostrum* squamose nearly to the antennae, coarsely and densely punctate throughout; with a very fine, vague median carina behind the antennae. *Antennae* with the scape as long as the first five funicular segments, with a few elongate scale-like setae beyond the middle; first funicular segment stout, somewhat longer than the second and more than one-fourth broader, the second about as long as three plus one half of four, four to seven moniliform; club slightly longer than the preceding four segments. *Prothorax* distinctly broader than long (3:2.5), base shallowly bisinuate, rounded on the sides from the base to the anterior margin of the lateral fascicle and thence rather abruptly but not very strongly constricted, the rounding of the sides slightly interrupted by a slight indentation at about half way between the base and the lateral fascicle; the four median fascicles low and rounded, the middle pair not well developed, the lateral pair situated inside of the lateral angulation or constriction, the apical pair consisting of short, loose, stout setae rather than a compact fascicle. *Scutellum* not protuberant, comparatively small. *Elytra* slightly more than three fourths as broad as long, almost three times as long as the prothorax; base rather strongly trisinuate, subparallel-sided from the roundly rectangular humeri to behind the posterior margin of the transverse fascia and thence broadly rounded to the apex; striae well defined, the punctures deep but not very large, normally concealed by the scaling; all the intervals with rather small round pustules formed of erect scales around a stout, erect, spatulate seta; interval three with an elongate callosity extending from the base to slightly more than half way between the base and the anterior margin of the transverse fascia, this bearing a well-developed fascicle, with the pustules somewhat condensed at the anterior part of the transverse fascia, and tending to form a vague, indistinct fascicle; interval five with a similar but smaller, less strongly developed, distinctly less conspicuous, elongate fascicle; humeral calli well developed; the posterior calli broad, not conspicuously protuberant; the intervals otherwise without fascicles or raised calli. *Legs* with concolorous vestiture; with numerous, short, slanting, spatulate setae projecting through the scaling; the femoral tooth rather small and sharp. *Sternum* with the tubercles before the inner edge of the mesocoxae on the mesosternum obsolete or nearly so; metasternum distinctly, but slightly, concave for the reception of the rostrum between the mesocoxae, the ventral anterior margin terminating in front of the posterior

margin of the mesocoxae in the male. *Venter* with the hind margin of the first ventrite broadly and distinctly emarginate at the middle, with an antebasal row of large, deep punctures that show through the dense scaling as a distinct, impressed line; second ventrite broadly and flatly arcuate behind. Length, 6 mm.; breadth, 2.75 mm.

Yandina, Russell Islands, Solomon Islands. Holotype male collected by Dr. W. M. Mann to be deposited in the Museum of Comparative Zoology at Harvard College.

The hemisphere of dark scales at the base of the prothorax, the broad, dark band across the elytra, the dark patch on either side of the scutellum together with the brownish-yellow background make this species easy to distinguish from all the other described species.

Deretiosus manni, new species.

Female. Derm reddish-brown throughout, concealed by the dense scaling; head and rostrum with fawn-colored scales; prothorax basically fawn-colored with a few dark scales at the base before elytral interval four, with a somewhat paler median vitta, and with the erect setae darker brown, especially in the fascicles; scutellum with white scales; elytra basically fawn-colored, with a short white patch at the base of interval three and with a few white scales along the base of the shoulder, the first fascicle on the third interval forming a conspicuous, but not very large, dark brown patch, with some dark brown scales between the fascicles, the most conspicuous mark a dark brown, open Y that extends from the posterior fascicles on the third interval to the suture to form a short stem on the first intervals that extends slightly behind the middle, with dark brown scaling forming an almost solid, but rather vague, triangle on the sides, the apex of which begins on the fourth interval at the anterior margin of the posterior fascicle on the third interval to the lateral margin of the elytra, its anterior margin reaching the elytral margin at its anterior corner but passing beneath the posterior edge of the humerus, its posterior margin reaching the lateral edge of the elytra near the hind margin of the first ventrite, the elytra otherwise with small spots of paler or darker scales and setae but with no conspicuous markings; legs with the femora with two darker dorsal bands, indistinct on the fore pair, but conspicuous on the hind pair; scaling below nearly white with the mes-epimeron and met-episternum fawn-colored.

Head with dense, deeply concave scales arranged like honeycomb, with but few, short, stout setae barely protruding above the scaling on the forehead and with about three slightly longer setae at the inner, lower margin of the eye; the interocular area but slightly depressed. *Rostrum* squamose almost to the antennae, with two rows of sub-erect narrowly spatulate setae on the sides from the antennae nearly to the apex, otherwise shining, densely and finely punctate and with a few minute scales and setae. *Antennae* with the scape as long as the first six funicular segments, with a few elongate, squamiform setae near the apex; first funicular segment slightly longer than two and almost twice as broad, two about as long as three plus four which are slightly longer than broad; club about as long as the preceding four segments. *Prothorax* distinctly transverse (3.7:2.8), base almost truncate, just perceptibly sinuous; slightly narrowing on the sides in front of the rounded basal angles to the anterior margin of the lateral fascicle and thence sharply constricted; the four median fascicles small and low, all about the same size, the lateral ones situated slightly within the lateral angulations, the anterior fascicles consisting of loose clusters of heavy setae on either side of the median line; the scaling like honey-comb. *Scutellum* cordiform, flattened, not pro-

tuberant. *Elytra* about three fourths as broad as long, about two and two thirds as long as the prothorax; base lightly trisinuate; subparallel-sided to about the distal third and thence broadly rounded to the apex; the striae fine, but deep and conspicuous, their punctures concealed by the scaling; all the intervals with short robust setae usually surrounded by small pustules of erect scales; interval three with two low, elongate, fasciculate callosities, one beginning just behind the base, the other terminating at about the middle, otherwise without distinct calli; the posterior calli not well defined, the humeral calli not very strongly elevated, the fifth interval with a vague, indistinct callus near the base. *Legs* with the femoral tooth small and sharp, the tibiae almost straight. *Sternum* with the mesosternum without a tubercle in front of the mesocoxae; metasternum almost evenly inclined with the mesosternum in the pectoral canal, but slightly, though distinctly concave for the reception of the rostrum, with a deep, bare, crescent-shaped, median impression at the hind margin. *Venter* with the setae depressed, none conspicuously erect; first ventrite roundly emarginate in the middle, second but slightly arcuate behind. Length, 4 mm.; breadth, 2 mm.

Three Sisters Islands, Solomon Islands. Holotype female to be deposited in the Museum of Comparative Zoology at Harvard College, collected by Dr. W. M. Mann for whom the species is named in recognition of his work in the Solomon Islands.

This species may be readily distinguished from the other Solomon Island species by the black V or Y of scales at the middle of the elytra and by its having distinct, fasciculate calli on the third intervals only.

Deretiosus sternalis, new species.

Female. Derm reddish-brown throughout, hidden by dense scaling; head and rostrum with brownish-yellow scales; prothorax brownish-yellow, with a conspicuous dark brown patch of scales that extends from the base in front of the fourth elytral interval to the inner sides of the lateral fascicles, the median fascicles for the most part very dark brown, nearly black, the dark area with some pale scales between the scutellum and the median fascicles; elytra basically brownish-yellow, with a subquadrate, dark brown scutellar patch on the first two intervals that extends posteriorly for a distance about equal to that between the scutellum and the median pronotal fascicles, the fascicles on the third interval with somewhat darker brown scales than the background, with a large, sub-trapezoidal paler area on the declivity that extends from the posterior calli on the fifth intervals converging anteriorly to the second calli on the third intervals, the elytra otherwise with small, scattered spots and patches of dark brown scales and with no other conspicuous markings; legs brownish-yellow, with two dorsal dark brown bands on the femora; scaling below predominantly brownish-yellow, somewhat paler than above, with the lower corner of the met-episternum dark brown.

Head slightly flattened between the eyes, with but few short setae showing through the dense, erect spongy scaling, with three longer, erect setae at the inner margins of the eyes. *Rostrum* squamose at the base and on the sides to the antennae; finely, vaguely tricarinate between the base and antennae, shining, densely and finely punctate. *Antennae* with the scape as long as the seven funicular segments, with a few elongate, scale-like setae near the apex; first funicular segment stout, as long as the second but about one-third broader, two not quite as long as three plus four, segments four to seven moniliform; club narrow and long, as long as the preceding six funicular segments. *Prothorax* about one fourth broader than long; base lightly bisinuate; almost straight on the sides from the base to below the anterior margins of the lateral

fascicles and thence rounded to the apex; the lateral fascicles well developed and situated above the lateral angulation, with only three or four erect setae projecting from them, the median fascicles more strongly developed, higher, more pointed, and with numerous longer, projecting setae; the anterior fascicles poorly developed, consisting of loose clusters of stout erect setae with comparatively few erect scales; with a conspicuous row of horizontally projecting setae on the anterior margin, elsewhere with scattered erect setae; scales concave, tending to become inclined or erect in front of the median fascicles. *Scutellum* slightly convex, clothed with dark brown scales. *Elytra* about three fifths as broad as long, three times as long as the prothorax; rather strongly gibbous; subparallel-sided from the slightly trisinuate base almost to the posterior calli; striae fine, the punctures not or but slightly visible through the scaling; all the intervals with erect, peg-like setae, the first four without distinct pustules surrounding them; interval three with a rather narrow, elongate, conspicuously fasciculate callosity extending from the base caudad for a distance almost as great as the length of the prothorax, with a short fascicle behind this about the size of the lateral prothoracic fascicle; interval five with several distinct pustules and with the posterior callus conspicuously fasciculate; interval six with almost no distinct pustules, seven with numerous pustules behind the well-developed, elongate, fasciculate humeral callus, eight and nine with pustules. *Legs* with numerous, short stout setae protruding through the dense scaling; the femoral tooth narrow and sharp. *Sternum* with a deep, coarsely punctate suture before the anterior edge of the metasternum separating a narrow, rectangular sclerotic ridge which projects over the pectoral canal within the inner edge of the mesocoxae but does not meet in the middle, the metasternum, therefore, overhangs the pectoral canal on the sides at the inner hind angles of the mesocoxae but not at the middle. *Venter* with the first ventrite roundly emarginate at the middle behind; the second ventrite but slightly arcuate behind. Length, 5 mm.; breadth, 2.5 mm.

Three Sisters Islands, Solomon Islands. Holotype female collected by Dr. W. M. Mann to be deposited in the Museum of Comparative Zoology at Harvard College.

This species is unique for the structure of its metasternum. It can be easily distinguished from the other Solomon Island *Deretiosus* by its color pattern.

Deretiosus concolor, new species.

Derm reddish-brown, concealed by the dense scaling; scaling almost uniformly muddy-brown above and below, slightly paler below, usually with a faint M or wavy transverse line of pale scales across the elytra at the top of the declivity, scaling at the base of the third interval somewhat darker, otherwise without conspicuous markings.

Head distinctly and broadly impressed and flattened between the eyes, the dorsal contour, therefore, sinuous; with a few short, stout setae showing through the dense scaling and a row of three or four erect, spatulate setae at the inner margin of the eye near the base of the rostrum. *Rostrum* more cylindrical in the female than in the male and squamose not more than one half the distance from the base to the antennae, very minutely punctate beyond the antennae; densely squamose almost to the antennae in the male, distinctly and comparatively coarsely punctate to the apex. *Antennae* with the scape as long as the seven funicular segments plus one fourth of the club, with some scales and setae on the distal third; first funicular segment as long as two but very stout and almost twice as broad, two not quite as long as three plus four, which are subequal in length, five and six equal and moniliform, seven longer than six, as broad as long; club slightly longer than the four preceding seg-

ments. *Prothorax* about one fifth broader than long, base strongly bisinuate, almost straight on the sides from the base to beyond the middle and abruptly and deeply constricted in almost a right angle at the anterior edge of the lateral fascicle, the apex rounded; densely punctate throughout, the punctures each capped by a large scale, the interstices very narrow and often appearing through the scales as a rather fine reticulation; the two lateral and two median fascicles strongly developed, the lateral ones forming the lateral angulation, the anterior pair less compact and not so well defined. *Scutellum* sub-triangular, densely clothed with spongy, brown scales. *Elytra* about three fourths as broad as long, almost three times as long as the prothorax (7:2.5), strongly trisinuate at the base, subparallel-sided from the roundly rectangular humeri to about the apical third and thence rather sharply narrowing to the apex; strial punctures distinctly showing through the scaling, becoming larger laterally, not bearing conspicuous setae; the first two intervals each bearing a row of erect setae but without fascicles, three with a callosity about as long as the breadth of the first three striae and separated from the base for about the same distance and bearing a loose fascicle, with two or three small rather irregular callosities at about the middle, otherwise with setae as those on intervals one and two; interval four without distinct callosities; interval five with a subbasal callosity similar to that on three but smaller and closer to the base, with several, small, variable callosities between this and the feeble posterior callus; interval six without distinct callosities; intervals seven and eight forming the conspicuous humeral callus which does not bear a distinct fascicle, otherwise without conspicuous callosities. *Legs* densely squamose and with numerous, scattered, slanting, subtubular or lanceolate setae; the femoral tooth strongly developed, acute. *Sternum* with the mesosternum with two tubercles before the mesocoxae, the outer one blunt and less conspicuous; pectoral canal terminating just behind the mesocoxae in the male, well behind the posterior margin of the coxae in the female; metasternum with numerous, scattered setae protruding above the scaling. *Venter* with the first ventrite sinuous behind; second ventrite broadly arcuate behind, the third ventrite, therefore, being broader on the sides than at the middle; fifth ventrite with large coarse punctures. Length, 6-7 mm.; breadth, 2.75-3.25 mm.

Ponape Island, Caroline Islands (the specimens bear old labels reading "Ascension Is. S. Sea". Ascension is an obsolete name for Ponape). Holotype female, allotype male and two female paratypes. The holotype and one paratype will be placed in the Museum of Comparative Zoology at Harvard College, the allotype and one paratype in Bernice P. Bishop Museum.

This species is to be recognized by its nearly uniform, dull color, and by the arrangement of the calli and fascicles. It cannot be confused with any other species known to me.

This is the first record of the genus occurring in the Caroline Islands. I have another undescribed species from Truk Island, and it is probable that many species will be found on the various Caroline Islands when they are carefully explored.

Orochlesis in the Solomon Islands (Coleoptera, Curculionidae)

BY ELWOOD C. ZIMMERMAN
Bernice P. Bishop Museum

(Presented at the meeting of December 3, 1937)

Heretofore, the cryptorhynchine genus *Orochlesis* Pascoe, 1873, has not been recorded from the Solomon Islands. In my review of the genus (Bishop Museum, Occasional Papers, vol. 12, no. 1, 1936), I listed 16 species distributed from the Malay Peninsula to the Society Islands. In a later paper (Orochlesis of Fiji, Bishop Museum, Occasional Papers, vol. 12, no. 22, 1936), I added four new species to the Fijian fauna to make a total of seven species from Fiji. Three species have been recorded from islands adjacent to Papua, but none have been described from the mainland; neither has the genus been found in New Caledonia nor the New Hebrides. Numerous species undoubtedly occur in those regions, however. The finding of the genus in the Solomon Islands reduces a geographical gap of almost 2,000 miles by approximately half. We may safely assume that the genus has a continuous distribution from Malaya to eastern Oceania.

The specimens representing the new species herein described were sent to me from the Museum of Comparative Zoology at Harvard College through the cooperation of Mr. P. J. Darlington.

Orochlesis conspersa, new species.

Derm black, moderately shiny, with the antennae and tarsi reddish-brown; densely clothed above with black scales interspersed with patches of brown, pale brown and white scales; scaling on the head dusky with a slight iridescent tinge and with a few scattered white setae on the crown and a line of pale setae along the inner margin of each eye; pronotum with pale brown to white scales interspersed with black scales and setae, the pale scales distinctly predominating, with a basal patch of dark or black scales before the second and third elytral intervals; scaling on the elytra basically very dark brown or black, but tesselated with many patches of pale brown scales; each elytron with the scales of the posterior callus white, making a small but conspicuous white spot, the second or second and third usually with a distinct, variable, pale area of either very pale or white scales at about the middle, the fourth interval with a patch of white scales just before the middle in front of the pale patch on the second and third intervals, all of these pale patches distinct and noticeable to the unaided eyes, the median patch on the second and third intervals the most indefinite, scaling on the legs similar to that on the head, picked out with white, elongate, squamiform setae; scaling below pale to dusky.

Head coarsely, densely, reticulately punctured on the crown and interocular area, each puncture bearing an oval scale or slanting, subsquamiform seta; interocular area only one half as broad as the base of the rostrum, straightly expanding from the top of the eyes distally. *Rostrum* very coarsely punctured as the interocular area to about half way between the eyes and the

antennae, thence shiny and minutely punctate to the apex. Antennae with the scape as long as the first three funicular segments; first funicular segment slightly shorter and not broader than the second which is as long as three to five inclusive, segments three to seven successively slightly shorter and broader; club as long as the preceding five segments, in clean specimens very densely clothed with short white or grey pile and sharply contrasting in color with the shiny, reddish funiculus. *Prothorax* about three fifths as long as broad, strongly rounded on the sides from the bisinuate base to about the apical fourth and there slightly constricted, the subapical constriction continuing deeply and conspicuously across the dorsum which is otherwise strongly convex; coarsely and densely punctate, the interstices of the discal punctures about half as broad as the diameters of the punctures, each puncture bearing and capped by a large round scale or stout, subsquamiform, anteriorly inclined, prostrate seta, the scales three or four times as large as those of the elytra and but slightly imbricated but almost completely concealing the derm; the setae condensed in a small patch on either side of the median line at the apex. *Scutellum* bare, shiny, convex. *Elytra* slightly more than two thirds as broad as long, two and one-half times as long as the prothorax; base very slightly concave on either side of the scutellar emargination, subparallel-sided from the base to about the middle, thence broadly arcuate to the rather pointed, but obtuse, apex, strongly convex, strongly gibbous in longitudinal dorsal outline, highest at one third from the base; striae squamose and but slightly impressed between the punctures which are large, deep, round and conspicuous; intervals broader than the strial punctures, flat, densely squamose, each bearing a row of posteriorly inclined black or white setae usually borne from low, polished tubercles. *Legs* with the femora edentate, densely squamose, coarsely and densely punctate; tibiae strongly flattened, the fore pair distinctly concave along the posterior face and finely, longitudinally carinate along the lower edge of the anterior face; first tarsal segment as long as two plus three, second one third longer than broad, as long as the third which is slightly broader than long and three fifths as long as the fourth. *Sternum* with the walls of the mesosternal receptacle rather flattened and on the same plane as the metasternum, not produced below it; metasternum closely set with large, coarse, round deep punctures, almost or quite as long as a metacoxal cavity at its narrowest point between the mid and hind coxae. *Venter* with all the ventrites squamose and setose, but not densely so, the first ventrite with rather coarse punctures at the base, smaller and less conspicuous caudad, the other ventrites shallowly and finely punctate but with the fifth somewhat more coarsely punctate than the second. Length, 3-7 mm.; breadth, 2.25-4 mm.

Solomon Islands: Holotype male, and two paratypes to be deposited in the Museum of Comparative Zoology at Cambridge, and two paratypes stored in Bernice P. Bishop Museum. All the specimens were collected by Dr. W. M. Mann, and unfortunately labeled only "Solomon Isl." with no additional data as to locality.

The holotype is a male with its aedeagus protruding. and although the female sex seems to be represented in the series, I am not certain of my diagnosis and have, therefore, not designated a female allotype.

This species is closely allied to the Fijian *Orochlesis eluta* Zimmerman, but on this species the walls of the mesosternal receptacle are on a continuous plane with the metasternum and not at all produced below it as they are in *O. eluta.* The strial punctures on this species are larger and more conspicuous than those of *O. eluta.*

Thysanoptera of Kauai with Notes on the Incidence of Yellow Spot on Wild Host Plants[1]

BY K. SAKIMURA[2]
Pineapple Experiment Station
Honolulu, Hawaii

(Presented at the meeting of December 3, 1937)

A collection of thrips on Kauai and a survey of the incidence of yellow spot virus (of which *Thrips tabaci* Lind. is the vector) on wild host plants made in June 1937.

THRIPS COLLECTION

The writer had previously examined very few specimens of thrips from Kauai (4) and information on thrips of this island is meager. Sixteen species were collected on this trip, 3 of which have been previously recorded; the remainder were hitherto unrecorded on Kauai, or new species (Table 1).

Heliothrips rubrocinctus was common and widely distributed. *Chirothrips sacchari,* an endemic species in the Hawaiian Islands, was incidental on Kauai. Another endemic species, *Scirtothrips antennatus,* was quite common on panax as on Oahu. Burdock was the only plant other than panax from which this was collected, but it may have been an accidental host. *Anaphothrips swezeyi* was found commonly feeding on grasses on Kauai. The occurrence of *Taeniothrips alliorum* has previously been recorded and it is now found very widely distributed and present though never in large numbers, wherever onions are planted. *Taeniothrips hawaiiensis* was one of the most common species, as on the other islands, distributed widely and feeding on many varieties of flowers. Many additional new hosts were found. Examination of gladiolus flowers for the possible presence of *Taeniothrips simplex* always showed the presence of *Taeniothrips hawaiiensis. Taeniothrips simplex* has been recorded from Oahu, Maui and Hawaii but it appeared to be absent on Kauai. *Thrips abdominalis,* a widely distributed species, was also found on Kauai, where it was subincidental. *Thrips nigropilosus,* another widely distributed species, was found infesting plantago heavily at 3,000 to 3,500 feet above sea level along the Waimea Canyon road. The finding of this species in the Hawaiian Islands is very recent and the known distribution is limited to Honolulu, Oahu, and Mt. Haleakala, Maui (6,000 feet above sea level). The addition of the present record, indicating wide distribu-

[1] Published with the approval of the Director as Technical Paper No. 113 of the Pineapple Experiment Station, University of Hawaii.

[2] This investigation was conducted under the direction of Dr. Walter Carter, Entomologist.

tion and establishment in the wilderness at very high altitudes is suggestive of earlier invasion of Hawaii than has been supposed. The brachypterous form was first collected in the Hawaiian Islands. The macropterous form was also present but was collected from separate spots and the brachypterous form was predominating in number. *Thrips panicus,* a common grass feeder, was also present on Kauai. *Thrips tabaci* was found to be one of the most common species, distributed widely from wet Haena to dry Mana and from the seashore to the top of Waimea Canyon. Six new host plants were found for this polyphagous thrips. Onions were heavily infested everywhere, and a moderate population was also found on *Emilia* which was densely distributed throughout the cultivated lowlands. The abundance of other weed hosts was also observed. The relationship between the *Thrips tabaci* and the yellow spot virus incidence is discussed in another part of the paper. Three new species of *Isoneurothrips,* which will be described later, were collected from wild hosts, all at non-cultivated high altitudes. Fourteen species of the genus *Isoneurothrips* have been recorded from Formosa, Siam, Sarawak, Java, Australia, Marquesas, and the Hawaiian Islands. Six of these are from the Hawaiian Islands and now 3 other species are added. A good-sized colony of *Microthrips piercei,* an uncommon species, was found on carrots, the first record on a crop plant. This species had previously been collected only from cocklebur and another minor plant. Subsequently, in a truck garden on Oahu, lettuce, chard, beet, eggplant and radish were very recently found uniformly infested with a minor population and without noticeable feeding injury upon these crop plants. *Haplothrips gowdeyi* was also found to be one of the most common widely distributed species feeding upon various hosts. Ten new host plants were added to the previously recorded 55 plants. *Haplothrips melaleuca,* a predacious species, was also distributed on Kauai, where it was subincidental as on the other islands.

INCIDENCE OF YELLOW SPOT VIRUS ON WILD HOST PLANTS

Yellow spot disease of pineapple has been known from the island of Oahu since 1926 and subsequently from the islands of Hawaii, Maui, Lanai and Molokai, but it was not recorded from the island of Kauai until 1935.[3] The disease has since appeared in the Koloa-Kalaheo-Hanapepe district, and was first reported in the Anahola-Moloaa district in 1937 (fig. 1). The general sources of infection for pineapple plants are not the infield infected pineapple plants. However, the outfield infected *Emilia,* which is the major wild host plant of the virus due to its abundance, high susceptibility and vector's preference, serves as sources of dispersal

[3] Includes the unpublished data collected by the various members of the station. Dr. M. B. Linford first surveyed the island of Kauai for yellow spot in 1935.

of the vector (1, 2). Search for such sources of infection in both districts was undertaken and the data are briefly summarized here.

Four different species of *Emilia,* which are all introduced species, were found on Kauai, namely: *Emilia sonchifolia* DC.[4] (red flower, common species), *Emilia No. 3* (3) (purple flower), *Emilia No. 4*[5] (purple flower, with creeping and perennial growth), and *Emilia coccinea* (Sims) Sweet (orange flower, incidental species). Some of these *Emilia* were found more or less restricted to certain plant associations which served as separate geographical and epidemiological reservoirs for the virus.

Emilia sonchifolia. The habitats of this species were found restricted to sparse secondary wild growth, i.e., roadsides, city lots, ditch banks, eroded hillsides, fallow land, recently abandoned fields, sugar and pineapple fields, and other cultivated land. These were not found among dense wild growth, i.e., forest areas, densely covered hillsides and gulches, grassy grazing and waste land, sand beaches and rocky shores.

Emilia sonchifolia was found commonly in the dry districts of Kauai, especially in the Lihue-Koloa-Kalaheo-Hanapepe district. However, it was not observed in the Makaweli-Mana district, but few were found at high altitudes along the Waimea Canyon road. In the wet districts it was very rare, and incidental plants were found scattered in the Wailua-Hanalei district. *Emilia sonchifolia* was abundant in and around pineapple fields of the Koloa-Kalaheo-Hanapepe district. The thrips population on it was moderate, and a high percentage of *Emilia* was infected by yellow spot. The disease on pineapple plants, ranging from minor to moderate in severeness, has been known to be present for some time and the incidence of virus on wild host plants has been well established throughout the district. It is presumed that all of the infected *Emilia* within the area were serving as the prevailing sources of infection for pineapple plants. The thrips population on *Emilia sonchifolia* outside of this district was small, and disease infection was not found west of Hanapepe nor east or north of Halfway Bridge (between Lihue and Koloa).

In the Koloa-Kalaheo-Hanapepe district, *Emilia No. 3* and *No. 4* were distributed west of Nawiliwili as far as Hanapepe but majorly along the shore line and away from the plant association of *Emilia sonchifolia,* and there were not infected with yellow spot virus. According to the observations of Dr. Linford (unpublished data), these *Emilia No. 3* and *No. 4* were found in 1935 mixed with *Emilia sonchifolia* in pineapple fields and surrounding abandoned areas of the Koloa-Kalaheo district and were found there infected with yellow spot virus.

[4] *Emilia sagittata* (Vahl) DC. which has been used for the Hawaiian species is a misdetermination (3).

[5] Determined by Mr. E. Y. Hosaka of the Bishop Museum.

Emilia No. 3 and No. 4. Favorable habitats of *Emilia No. 3* and *Emilia No. 4* were found essentially similar, but entirely different from those of *Emilia sonchifolia.* These were narrow zones along the seashore passing through the open shore hillsides, beach roadsides, waste land, grazing land, sand dunes and rocky beaches. However, shady forests, dense growth of tall lantana or grass in gulches, cultivated land and other sparse secondary wild growth were not their preferred habitats. Among the above-mentioned habitats, these two species of *Emilia* were found usually dominating the association (unless disturbed by grazing or other factors) in open areas of dense short grass sod (commonly of carpet grass).

Emilia No. 3 was found distributed from Wainiha to Hanapepe along the shore line (33 stations were checked). It was not found along the shore from Hanapepe to Mana where it was dry and the vegetation was highly disturbed, and along the shore of Haena where the forest approaches it directly. Incidental stands were found inland sometimes. In the vast waste land located between the seashore and cultivated area of the Kapaa-Anahola-Moloaa district, a very thick growth of this *Emilia*—highly dominating the association—was found.

Emilia No. 4 was found associated with the dominating *Emilia No. 3* throughout its distribution and was most abundant simultaneously in the Kapaa-Anahola-Moloaa district.

The thrips population on *Emilia No. 3* and *No. 4* ranged from none to moderate. No infestation was found on plants with leathery leaves growing near windy and dry shores. The highest population was present near Anahola gulch. In spite of the 50 miles' distribution of these *Emilia,* the infection with yellow spot was locally restricted to about 15 miles. The highest concentration of the disease (ranging from 25 per cent to 100 per cent with different samples) was found near Anahola gulch where the highest populations of *Emilia* and thrips were simultaneously present. The disease infection gradually decreased toward Moloaa and the Lihue Airport. Other isolated infections of very minor percentage of plants were present near the Nawiliwili waterfront. The localized heavy infection near Anahola gulch and its wide expansion suggest that the successful invasion of the virus in this district has not been of this season, but probably after January 1935 when Dr. Linford found no incidence of virus on wild host plants north of Koloa gap (unpublished data).

The pineapple fields in the Anahola-Moloaa district were located on the coastal plateau, and a wide strip of waste land, where a well established and concentrated potential source of infection existed, was sandwiched between the shore and these fields. The prevailing wind blows from the sea toward the pineapple fields through the waste land. *Thrips tabaci,* the vector of yellow spot, has been known not to migrate readily but would disperse when its food supply is

disturbed by drying, grazing, weeding, or other purely biological causes (1). Such a dispersal seemed to have happened in the present case which caused the sudden and first appearance of the disease on pineapple plants (moderate in severeness), in spite of the preceding outfield establishment of the virus. Another probable factor would be a sudden increase of the vector population occurring under the prevailing ecological conditions. A higher infection of pineapple plants was found along the margin of the fields adjacent to the waste land. In this district the population of *Emilia sonchifolia* was very small and the pineapple fields were practically free from it. The incidence of virus on inland *Emilia sonchifolia* was not observed and it is therefore concluded that it did not form an additional source of infection.

In the Lihue Airport-Kealia district, *Emilia No. 3* and *No. 4* were infected, but pineapple plants were not present except a few at the Kapaa Homestead, far distant from the coast. In the Hanalei

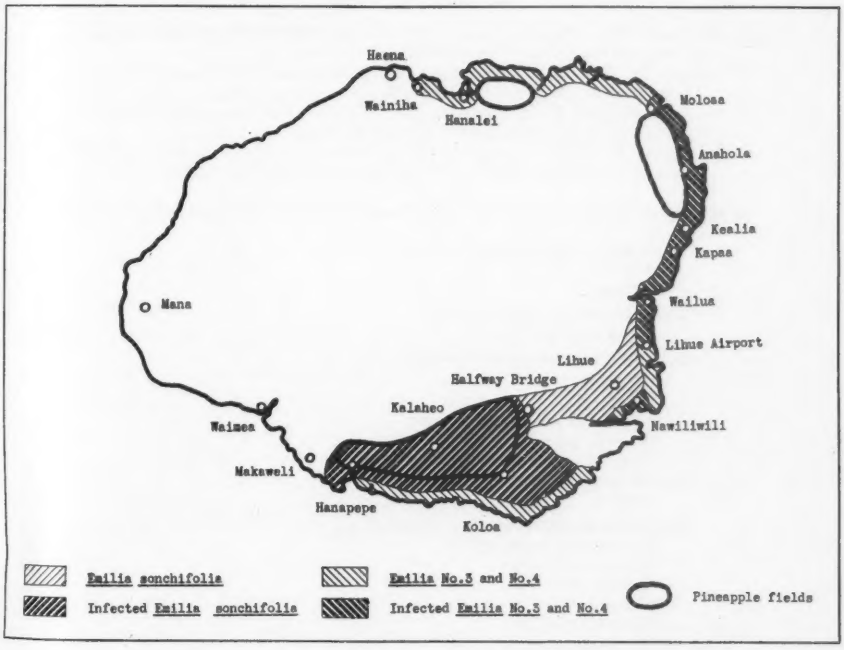

Figure 1. Sketch map of the island of Kauai showing geographical distribution of *Emilia* and incidence of the yellow spot virus in the *Emilia* population, as observed in June, 1937.

district pineapple plants were free from disease associated with an absence of infected *Emilia*.

Concerning the probable introduction of yellow spot virus into the Anahola-Moloaa district from the Koloa-Kalaheo-Hanapepe district, details have not been known beyond mere possible surmising.

SUMMARY

Sixteen species of thrips were collected from Kauai; of which 13 are hitherto unrecorded on that island, or new species. Faunal characteristics are not different from those of the other islands of the Hawaiian group.

In one locality the sudden appearance of yellow spot of pineapple was preceded by a firm establishment of the virus on nearby wild host plants, *Emilia No. 3* and *Emilia No. 4* serving as typical outfield sources of infection.

LITERATURE CITED

1. Carter, Walter. Populations of *Thrips tabaci* Lind. with special reference to virus transmission. (Manuscript)
2. Linford, M. B. 1932: Transmission of the pineapple yellow-spot virus by *Thrips tabaci*. Phytopath. 22(4):301-324.
3. St. John, H., and E. Y. Hosaka. 1932: Weeds of the pineapple fields of the Hawaiian Islands. Univ. Hawaii Res. Bul. 6:1-196.
4. Sakimura, K. 1937: A survey of host ranges of thrips in and around Hawaiian pineapple fields. Proc. Haw. Ent. Soc. 9(3):415-427.

TABLE I. THRIPS COLLECTED AND THEIR HOST PLANTS ON KAUAI

†**Heliothrips rubrocinctus** (Giard)
*Guava
Mango

†**Chirothrips sacchari** Moulton
**Setaria geniculata*

†**Scirtothrips antennatus** Moulton
Panax
*Burdock

†**Anaphothrips swezeyi** Moulton
**Setaria geniculata*
**Tricholaena rosea*

Taeniothrips alliorum Pr.
Onion

†**Taeniothrips hawaiiensis** (Morgan)
**Commelina nudiflora*
**Hemerocallis flava*
*Easter lily
*Gladiolus
**Mirabilis jalapa*
*Hydrangea
Alfalfa
**Acacia koa*
Ipomoea sp.
**Hypochaeris radicata*

†**Thrips abdominalis** Crawford
**Emilia coccinea*

†**Thrips nigropilosus** Uzel (macropterous and brachypterous forms)
**Plantago lanceolata*

†**Thrips panicus** Moulton
**Setaria geniculata*

Thrips tabaci Lind.
Onion
Mirabilis jalapa
*Cabbage
Alfalfa
**Acacia koa*
Carrot
Lantana camara
Solanum nodiflorum
*Tomato
*Tobacco
Emilia sonchifolia
**Emilia coccinea*
**Emilia Nos. 3* and *4*

†**Isoneurothrips** spp.
(Three new species were collected which will be described later)

†**Microthrips piercei** Morgan
*Carrot

Haplothrips gowdeyi (Frank.)
**Setaria geniculata*
**Paspalum orbiculare*
**Commelina nudiflora*
Gladiolus
Onion
Alfalfa
*Carrot
Ipomoea sp.
**Plantago major*
**Plantago lanceolata*
Richardsonia scabra
**Solanum nodiflorum*
**Emilia coccinea*
**Emilia Nos. 3* and *4*
**Hypochaeris radicata*

†**Haplothrips melaleuca** Bag.
**Emilia Nos. 3* and *4*

* New records of host plant in the Hawaiian Islands.
† Hitherto unrecorded species on Kauai.

Records of Immigrant Insects for the Year 1937

BY THE EDITOR

In this issue of the Proceedings, the following new immigrant insects are recorded for Hawaii. Those marked with an asterisk were observed for the first time at the date mentioned in 1937. The others were previously observed or collected, but herein correctly named or recorded for the first time. For details of records, etc., refer in the text to the pages given.

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